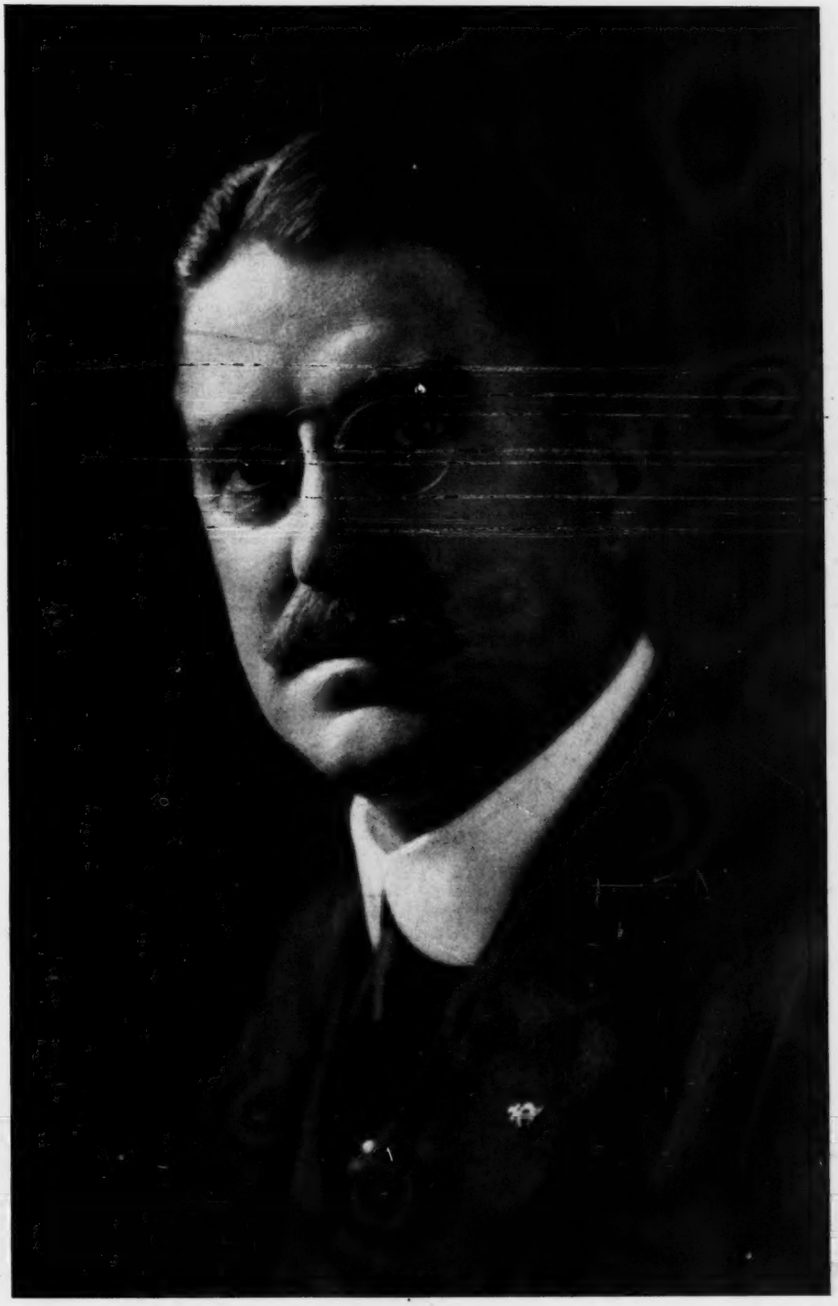
McGraw-Hill Company, Inc. Largest Circulation of Any Mining and Metal Journal in the World Price 25 Cents Per Copy

SCIENCE LIBRARY

October 15, 1921

ENGINEERING AND MINING JOURNAL

A WEEKLY JOURNAL OF THE MINING & MINERAL INDUSTRIES



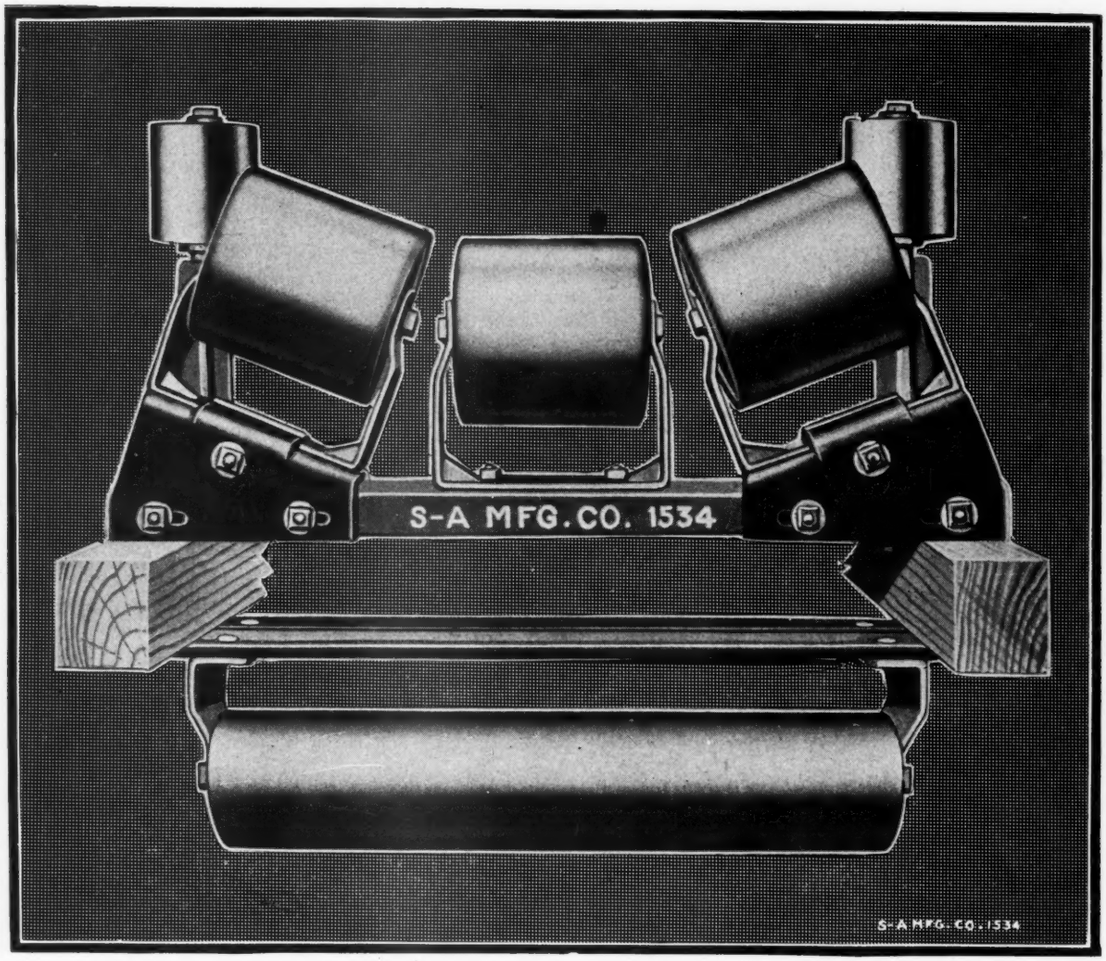
William J. Loring
President of the American Mining Congress

The Gulf Coast Sulphur Industry
By Albert G. Wolf

Mine Blacksmith Shops
By R. J. Day

Mining As Seen by Herodotus
By Sydney H. Ball

***Biography of* W. J. Loring**



Concerning

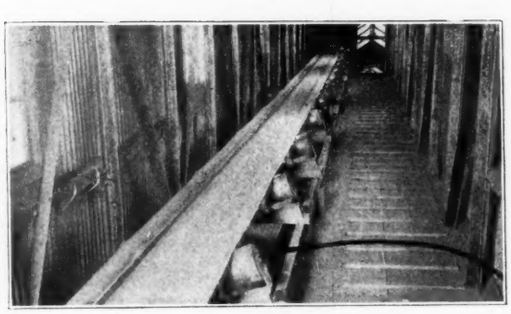
Conveyor Carriers

It is important that belt conveyors be equipped with good carriers

The S-A Unit Carrier may not be the least expensive when only purchase price is considered. The ultimate cost, however, of a conveyor carrier cannot be determined solely by its purchase price.

The reliable service given by the S-A Unit Carrier, in addition to the savings incurred in power, belt wear and lubrication, more than justifies the popularity, which is steadily increasing.

S-A Unit Ball-Bearing Conveyor Carriers Are Patented



The No. 26 Catalog "S-A Belt Conveyors" is a complete treatise on modern approved conveyor practice. Write for your copy.

Stephens-Adamson Mfg. Co., Aurora, Illinois

J. E. SPURR
Editor
G. J. YOUNG
Western Editor
D. E. A. CHARLTON
Managing Editor
A. H. HUBBELL
News Editor
E. H. ROBIE
Metallurgical Editor

Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries
METALS NON-METALS PETROLEUM

F. E. WORMSER
W. N. P. REED
Assistant Editors
BENJAMIN L. MILLER
ROBERT M. HAIG
J. VOLNEY LEWIS
Special
Consulting Editors

Volume 112 New York, October 15, 1921 *Number* 16

The Opportunity for Copper Producers Is Still Open

THE CHIEF HANDICAP in popularizing the use of copper is the high price charged by jobbers and retailers. We have spoken about this before, and expect to do so again, for it is of importance. Heretofore, the copper-mining interests have not been concerned about their product after the raw material is sold. It is to their credit that they have retained the right of selling it instead of allowing the market to pass into the hands of traders and speculators, as is the case with tin; but something further must be done. The Anaconda company pointed the way by establishing a rod and wire mill at Great Falls, and we understand that the venture has been successful. There is also a community of interest between the Phelps Dodge Corporation and the American Brass Co. The more producers and manufacturers get together, the better. All, however, have neglected the smaller business, feeling, no doubt, that it is too unimportant to be worth the effort. But here lies the big opportunity for expansion. Think of the increased demand for copper if even 10 per cent of the population of this country felt that it was advisable to have copper screens on their windows, copper roofs and gutters on their houses, copper tanks in their kitchens, and brass pipes for their plumbing, to say nothing of the innumerable other less evident purposes for which this metal is suited on artistic and economic grounds.

We would like to see the Anaconda company or the American Brass Co. or any other copper fabricator establish stores in, say, New York, Chicago, San Francisco, and New Orleans, or in New York alone as a starter, in which copper and brass products would be sold in large or small quantities at reasonable prices. A store where, if you or I wanted to buy a sheet of copper, we could get it for 25 or 30c. a pound instead of 75c. or a dollar; a store where copper would be the principal if not the only thing sold, and not a side line carrying undue overhead costs. Prices could be made very low at first. Possibly sufficient only to pay expenses, until the demand was cultivated. If such a project were properly handled and advertised we believe the results would be startling.

The increased building which must come in the next year or two to provide homes for everybody offers a particular opportunity for the establishment of such a store at this time. A builder who uses copper equipment in his house will find that it is half sold, for there will be little competition from older houses. Who of us has not seen copper leaders on a house, or copper screens, and thought to himself "that house must be well built; it has the earmarks of quality." With reasonable prices the builder will not find his extra investment prohibitive.

We are going to give a lot of free advertising to the first copper or brass company to start a retail store with common-sense prices.

Grouping of Washington Scientific Bureaus

REORGANIZATION of the Government bureaus and departments in Washington is a problem for which many solutions are offered. Classification is not so much a matter of science as of good judgment and practicability. A mass of heterogeneous materials, such as we have in Washington, can be classified almost any way—horizontally, vertically, or diagonally—or as the knights move on the chessboard; and in actual practice, or in the propositions submitted, we find examples of all these systems. A crowd may be classified according to color, or height, or sex, or dress, or education, or according to whether or not those composing it wear earrings; and it is easy to classify the Government organization and remodel it in many different ways. We recall the recent movement for a Department of Public Works, and the proposal to include under this all Government work into which engineering entered, in any walk of life, and a lot where it was rather difficult to see the connection with engineering. As engineering is essentially the application or setting to work of technical or scientific knowledge, practically all fields of intelligent endeavor could have been brought together under this plan, for now we have all kinds of engineers—not only mining, electrical, and the like, but the sanitary engineer, the efficiency engineer, and even the economic engineer.

Very similar is a recent proposition by a scientist, a criminologist of standing, to group all the scientific bureaus of the Government under one organization, that organization to be the Smithsonian Institution. In this group he proposes to place the Geological Survey, the Reclamation Service, the Bureau of Mines, the Patent Office, the twelve "scientific" bureaus of the Department of Agriculture, the Bureau of Standards, the Bureau of Fisheries, the Hygienic Laboratory, the Bureau of Public Health Service, the Army Medical Museum, the Government Hospital for the Insane, the Coast and Geodetic Survey, the Library of Congress, and part of the Census.

It will readily be seen that the suggestion implies a grievous misconception of conditions and how much worse such a grouping would be than what we have at present. Indeed, it is not a classification, but a mixing up, a shaking together in a bag, of many offices with many fields of activity, and the real job would be to try to classify and organize such a heterogeneous aggregation after the mixing process. At the moment we do not think of any department of the Government which might not come under the general designation of Science, for the State Department deals with political science, the War Department with military science, the Department of Labor with the science of sociology, and so on; so that the Secretary of the Smithsonian Institution, under this plan, might well be appointed, at the outset, assistant to the President.

Training the Miner to Mine

THE SUBJECT of vocational training for miners is one which has engaged the attention of at least one large mining company; it is a subject which we recommend especially to the attention of all employers. As a nation, we are strong for education. We teach the boys algebra and Latin, and send them out to a business career. Oh, a business career, certainly—what boy that has attended high school, as every boy of ambitious parents does, at the very least, would descend thereafter to learn a trade, and work with his hands? Better no job, and a white collar, than overalls and a solid livelihood.

Now here is a national movement, strongly supported by Washington and supplied with Federal funds, which proposes, for example, to teach the miner —what? Algebra? No. Geology and mineralogy? No. It proposes to teach him to be a first-class miner. It intends to teach the shift boss how to be an intelligent and efficient shift boss. Glory be! Shall we, indeed, have skilled workmen of our own, highly educated as to manual dexerity and common sense, and not be dependent on the half-trained and ignorant and therefore restless, vagrant, and discontented type of mine workman which must be tolerated in many mining camps?

The plan to educate the miner to be a first-class miner and give him a certificate as to his grade in his honorable calling appeals to us as one of fundamental and far-reaching worth. Increased efficiency, lowered cost, and, therefore, higher wages should result from this; more permanent mining camps, fewer strikes. The Federal Board for Vocational Education has considerable funds which it allocates to each state, to be matched dollar for dollar by the state, municipality, or other state source (evidently a mining company might be an eligible partner), and then to be used under the broad rules laid down by the board, and approved by the Cabinet members who constitute that board in part. These Federal funds are by no means working to full capacity; and if you desire to avail yourself of them in your local problem you probably will find that they are available.

The Bureau of Mines is interested in this problem, and its Division of Education and Publicity has given considerable attention to the matter. The Committee on Occupational Training of the Mining and Metallurgical Society of America, of which Charles A. Mitke, of Arizona, is chairman, has prepared a course for the instruction of miners along these lines, just issued as Bulletin 149 of the society. Write to any of these sources, or to us, if you are interested in this movement, which should be pushed as assiduously as the safety work in mines has been, and which has a broader scope.

Mine Hygiene in Australia

ADVICES FROM AUSTRALIA recite a curious situation as to the prosecution of Government work regarding the public health. An agreement was made between the Rockefeller Institute and the Australian government, whereby the former agreed to provide three experts if the government would create a Department of Health to co-operate. Accordingly, Dr. Lanza, well known from his studies of industrial (including mining) hygiene, and especially known to us from his papers published by the Bureau of Mines, in *Engineering and Mining Journal* and elsewhere, arrived in Australia in August. He found that the government has created, as agreed, a Department of Public Health, but that the slight formality of allotting to the new department funds from the treasury, and providing it with a personnel, had been overlooked. Now Dr. Lanza is perplexed as to how to deal with this entirely impersonal and personally unrepresented department. Evidently, in Australia they do not take the question of new departments in the government as seriously and heavily as we do in the United States. If it were so with us, doubtless our need and desire for a Department of Mines could be accommodated over night.

The Competition of Japanese Mining

STUDENTS OF COMMERCIAL CONDITIONS in Japan report that there has been little or no deflation from the war conditions in that country, and that consequently prices and living conditions are very high, without the attendant prosperity which during the war made high prices relatively of little moment, by and large, in Japan as well as the United States. The key to the situation is the price of rice, the national food, and the cost of this has been kept up by the agrarians, which group is dominant in the national parliament: and this by itself effectually blocks the process of general deflation.

Copper, of which Japan is an important producer, is accordingly in the position that the cost of production is as great or greater than the price of the metal; in which respect the Japanese conditions correspond with those in this country. It is evident that times have changed in more countries than our own, and that for the time being at least to talk of the danger of competition by cheap Japanese labor is an anachronism. Indeed, Japan some months ago found it cheaper to buy a quantity of copper from the United States than to produce it; although later, in the financial crisis through which she passed, she flung much of it back on the American market, liquidating it for ready cash.

In general, it would seem that the race for markets and consequent business prosperity is a race of deflation, which means a competition in lowering costs of production; for prices of raw materials and manufactured commodities are determined in the world market and by the world demand. In other words, costs are regional and national; prices are international. In this connection the process of deflation, of course, is a comparative thing, for the cost of producing depends upon the double factor of cost of supplies and efficiency in production. The greater the efficiency the higher the corresponding wage; so that deflation in this country to a point allowing competition with other nations does not mean leveling our wage scale to that of Japan or of Germany: in fact, to raise wages for increased efficiency is the best and normal way to secure low costs. But—no efficiency, no wage. Our producers—both labor and management—should learn and digest this just arrangement.

So the cry of cheap Japanese labor producing copper, of cheap Chinese labor producing antimony, of cheap Bolivian labor producing tungsten, is not well founded, as an argument, on fact and experience. As a matter of fact, Chinese labor is notoriously not cheap, but high; for though the laborer—miner or otherwise—may receive only a small stipend, he is inefficient. The same is true, almost as a law, of labor in other countries. A great international contractor once observed that he

found labor cost him the same in all countries, regardless of the wage. We ourselves have made some observations along this line, in mine sampling. In the course of many large mine examinations, in each of which some thousands of samples of uniform length, breadth, and thickness were cut, careful costs were kept, reduced to the individual sample as a unit, in order to be able to estimate the costs of other examinations more accurately. In the examinations in question the cost of the labor employed varied, at that time, from fifty cents a day in southern Mexico to four dollars a day in Colorado and Montana. The result of the investigation showed, with an abundance of data, that it cost almost exactly the same to cut a sample under all these varied conditions.

The Roodepoort Plan

THE NEWS ITEM from South Africa, discussed in our recent London letter, covering a proposed scheme for continuing work on the Roodepoort United, a Rand mine, on a copartnership basis between capital and labor, is of more than passing interest—indeed, it is a milestone in the development of capital-labor relations. The costs have become so high and the grade of the gold ore so low that the management finds it impossible longer to work the mine at a profit, or even to make it pay expenses and fixed charges. Shutting down of the property, cessation of payment of interests on the company's debt, and the throwing out of work of the miners is the normal conclusion. But the novel proposition has been made that the men are to work at one-half union wages; then out of the first earnings the interest on the company's debt is to be paid; next the full scale of wages is to be made up; and finally, anything left over is to be divided between the miners and the stockholders.

It will be interesting to see if the miners will take a gamble on this proposition and what the outcome will be. Certainly with every man working for himself, as he would be under this plan, he will not only do his best himself, both as to quality and quantity of work, but will see that his associates get into the collar and pull along with him. If the experiment succeeds, the men will have a sound argument for some such plan, or a modification of it, in more prosperous mining enterprises. They will be able to point out that if the arrangement can turn a hopeless operation into a self-sustaining one, it might be able to make a going operation more healthful and prosperous.

No rule will work out in all cases; and in many operations such a plan perhaps might never be practicable. In a high-grade mine the temptation might be to rob the mine of its richer ore, and endanger the future; but such a danger is always present at the hands of some manager ambitious for a showing, and especially of directors impatient for returns; and with the proper management and directors there would probably in most cases be little trouble from the miners on that score.

In any event, the endeavor to build up schemes of operation so that every man down to the mucker has some little stake and some little gamble in the operation, besides his daily wage, will be found to be one of the soundest principles of mine management. There are many ways of doing this, from the bonus system up to the extreme Roodepoort plan concerning which we write.

Human engineers—the managers of industry—would do well, in the interest of capital and of humanity, to make an intensive study of these principles, which will be essentially studies in leadership, in sound business, and in fraternal responsibility.

Anaconda Accident Rates

TABLOID FOOD is usually inefficient. Its potential food value may be high, but is unavailable unless diluted by other foods of lower food value. Statistics without the background of imagination are equally unassimilable, and without the visualization of general and sociological conditions cannot be accurately interpreted.

D. Harrington, of the U. S. Bureau of Mines, has presented in the Bureau's *Reports of Investigations* a summary of the accident record of thirty-two mines of the Anaconda Copper Mining Co. in Montana. The tabulation presents the serious plus the fatal accidents for each 10,000 shifts worked in each mine over a period of six years, 1915 to 1920, inclusive.

Butte is a compact community of which the principal industry is mining. It has been long established, and a considerable proportion of miners have been residents of long standing. What proportion of the miners are transient is not known, but undoubtedly Butte, like other Western mining centers, has a large proportion of "drifters." What the labor turnover for the Anaconda mines is we do not know. It would be an important factor in understanding the variations in the accident rate from year to year. A large labor turnover increases the accident rate. On the other hand, a considerable degree of stabilization of the mining community would reduce it.

A well-organized operating division is in charge of all of the mines, and the mining operations have been developed under excellent supervision through a period of years. Supplementing operation is a Bureau of Safety under the leadership of Charles W. Goodale. This bureau has persistently attacked the problem of reducing the mining hazard to a minimum by structural improvements, protection of machinery and working places, elimination of unsafe methods, and inculcating the safety first idea among the workmen. Neither brains nor expense has been spared. To the combined efforts of the operating division and the Bureau of Safety, together with the co-operation of the workers, must be given credit for the splendid record made in reducing to a minimum the drain upon man power caused by accidents in these mines.

Look for This Article

THOSE INTERESTED IN DREDGING and in the difficult problem of determining the value of placer properties through drilling cannot afford to miss the article on "Drilling Results and Dredging Returns," by Charles W. Gardner, which will appear in our Oct. 22 number. This is a subject on which there is altogether too little literature, too much divergence of theory and practice, and a lamentable proportion of failures due to incorrect, careless, and stupid methods of drilling, sampling, and calculation.

Mr. Gardner has been actively engaged in gold dredging for many years, and is manager for the Yuba Consolidated, in California. He is the dean of dredging men in California.

WHAT OTHERS THINK

The Tacna-Arica Problem

I do not know whether or not you relish criticism of articles printed in your magazine, but I am going to take a chance that you will accept the following criticism in a friendly spirit:

On page 481 of the Sept. 24 issue of *Engineering and Mining Journal* there is an article entitled "The Tacna-Arica Problem." This article states that mineral nitrates are found in the provinces of Tacna and Arica. I personally spent several years in Chile looking up and investigating various nitrate problems, but never once heard of any indications of nitrate occurring in these two provinces. The nitrate district in Chile runs approximately from the port of Taltal at the southern end to Pisagua at the northern end, and by glancing at a map of Chile you will note that Pisagua is a considerable distance south of Arica.

It is quite true that both Bolivia and Peru are unwilling to have Chile retain these two provinces, but my understanding is that the reason Bolivia desires the provinces is to obtain a seaport of her own instead of being forced to transport all of her imports and exports through either a Chilean or Peruvian port.

Wilmington, Del. G. B. STREET.

Encourage Copper Roofing

It is now drawing close to a year since most of the large copper producers were compelled to cease mining ore and producing copper; still, the outlook for the future of that metal is as yet far from bright. Several suggestions have been made of ways to increase consumption and find new uses for the metal, all of which deserve credit; but the fact remains that copper is not moving as it should be, and until such time as it does, we cannot look for a revival of the mining industry, which would mean a like revival in other lines and spell prosperity.

The President and Congress are wrestling with the problem of caring for the unemployed, which has all the earmarks of being a gigantic one. The various industries are asking for Government aid at this time, in the form of protective tariff on their products and raw materials; and it would seem that the copper industry is entitled to some Government aid, in view of the fact that this metal was produced at record speed even after the Armistice was signed, by order of the Government. This aid could have been rendered very nicely by the Government keeping the scrap copper, left from the war, off of the market, and by so doing protect the mining industry, but primarily protecting the Nation.

Another great war is not by any means improbable, and should it occur the United States will once more be clamoring for copper, together with other needed metals; and these will necessarily have to be produced under the pressure of rush and the resulting low efficiency of labor, which will mean peak prices will be paid for it, just as in the recent case. Had the Government kept the scrap copper, rolled it into plates and used it to cover the roofs of all Federal buildings in our land, it would have provided the best possible roof covering, would have to a large measure prevented the slump in mining, and set an example; for if the Federal buildings had copper roofs, all first-class building done in the future would have followed suit, and, above all, in the event of war and need of an immediate supply of copper, the Government would own it, and it would be only a matter of days to convert it into munitions of war, compared with the months necessary to produce it from the ground and to put it through the various metallurgical processes before it would be ready for use.

But is it yet too late to do this? The price of copper is low, and the Government would be looking to the future by buying copper and using it for this purpose; and it might even mean the guarantee of the liberty of America. J. F. INGLIS.

Baker, Idaho.

Why the Mining Engineer?

During 1914 I was in Butte. We had an old Cornish miner then whom everybody called Alec. I do not know his last name; that, however, does not matter. He was considered one of the best of the miners and the best timberman. He had been underground twenty-three years. One day at lunch time I volunteered the information that he must be pretty sick of it by that time and hoped that he would soon get a job in the carpenter's shop up on the surface as a reward of his undoubted merit. He just gave me a look, more surprised than unkind. His more experienced and wiser head discovered my innocent ignorance of the real values of the things in the world and assured me with a solemnity rarely associated with his buoyant face that he would surely die if he had to live to see the day when he could no more work underground. I felt sure he meant it. To a large majority of this metropolis, working in a dark hole is inconceivable even when bringing a large remuneration. Such are the ways of human beings.

Recently some of us were surprised to see sensible looking individuals filling the corridors of the Spanish Consulate volunteering to assume the uncertain responsibilities of being a member of the Foreign Legion of Spain to fight under the scorching sun of African deserts at 75c. per day. I dare say most of them would have gone even without that small remuneration. Something of this spirit every mining man has.

And again the sailor. Have you ever been seasick? I have. No money seems enough to go through the experience I had once off the coast of Ireland eleven years ago. Yet the men of the sea are reputed to be homesick for the ocean after an extended sojourn on the land. Those of your readers acquainted with Joseph Conrad's works will remember Captain MacWhirr. Did he grunt at roughing it?

Though it is to be conceded that the Anglo-Saxons excel in this supreme test of civilization, it must be mentioned to the credit of other nations that each has its representatives in the game of adventure and

undertaking that cannot be easily translated into terms of mundane advantages. Long live their memory! It is these men that we honor; even the most utilitarian among us bows his head before the altar of self-sacrifice.

So the mining engineers need not fall into despondency because a man in another trade and with no apparent superior qualifications is enjoying a better salary in the midst of home comforts. Consider the President of this big United States. The list of men and women who pay income taxes larger than the President's salary takes longer than one breath to read. There is a great deal of fun in doing things. DJEVAD EYOUB.

Brooklyn, N. Y.

Pressure Smelting of Zinc Ores Not a Success

Regarding the smelting of zinc ores in a blast furnace under pressure, as outlined by Mr. Evans W. Buskett in *Engineering and Mining Journal* of Sept. 10, I would refer metallurgists to the following literature on this subject:

A. Lencauchez, "Memoires de la Société des Ingenieurs Civil," 1877, pp. 568-580, abstract *Eng. and Min. Journ.*, Vol. 26, (1878), p. 111.

U. S. Patent 538,785, Emil E. Lungwitz, May 7, 1895.

Robert C. Schupphaus, *Journal Soc. Chem. Ind.*, Nov. 30, 1899, p. 987.

"Partial Pressure, Partial Volume, and the Lungwitz Zinc Process," *Electrochem. & Met. Ind.*, Vol. 3, pp. 408-409, November, 1905.

Fred W. Gordon, "The Langwitz Process of Zinc Smelting," *Eng. and Min. Journ.*, Vol. 81, pp. 795-797; Vol. 82, pp. 71-73; April 28, July 14, 1906.

U. S. Patent 974,257, Frederick W. Gordon, Nov. 1, 1910.

U. S. Patent 1,080,102, Elisha B. Cutten, Dec. 2, 1913.

W. McA. Johnson, "Tests on the Lungwitz Zinc Smelting Process," Min. & Met. Soc. Amer. *Bull.* 90, pp. 247-256, November, 1915.

A. Rzehulka, "Die Kontinuierliche Gewinnung von metallischens fluessigen Zink im Schachtofen," *Chem. Zeit.*, Vol. 38, pp. 895-897, 937-939; July 14, July 23, 1914.

The process, therefore, is not new. The Lungwitz method was thoroughly tested in 1905, and failed to produce spelter. The idea seems plausible, as 50 to 100 lb. pressure would prevent ebullition of zinc at melting temperatures; but owing to the large quantity of inert gas present, the total pressure required to give the necessary partial pressure of zinc vapor would be impossible of practical attainment.

Rolla, Mo. B. MARVEL O'HARRA,
Assistant metallurgist, U. S. Bureau of Mines,
Mississippi Valley Experiment Station.

Gives Credit to the Pine God

It is with some disappointment that I occasionally scan certain letters printed in your "What Others Think" department. Reference is to the publication of letters by Harbren, Groheigher, and others.

Either you are being victimized by fakes, pure and simple, or the letters are the genuine products of earnest but simple-minded citizens. If the latter is the case, it would seem beneath the dignity of the *Journal* to ridicule in this manner sincere but uneducated and visionary men. If these letters are fakes, that, of course, is your own business.

In this connection, however, I wish to narrate my own actual experience with alchemy. I have actually transmuted iron into gold through the discovery of an ancient manuscript, written by one Dios de Pino.

I am an old man now, but during youth and early manhood followed the sea. It was through a shipwreck on the coast of Corsica many years ago, when I was cast, the only survivor, to the beach, that I made the discovery. I found the manuscript lying beside me on the beach when I recovered consciousness.

A subsequent examination proved the writing to be in medieval Italian, and a cautiously obtained translation indicated that one of the old alchemists had actually been able to make gold.

Sir, I retired from the sea to manufacture gold. After a number of experiments, I was so successful that I made my pile and retired. I then destroyed the formula, and decided not to allow my discovery to be perpetuated. I did this not from selfishness, but because, were the secret to become known, gold would be worthless. The consequent wholesale manufacture of gold would, in my opinion, lead only to an economic cataclysm and, possibly, revolution terrible in its scope.

Bloomfield, N. J. BENJAMIN DOUBLEDAY.

A Correction

In *Engineering and Mining Journal* of Sept. 17 I am quoted as having said in my evidence submitted to the Finance Committee of the Senate on Aug. 26 as follows:

"If the proper protection were granted, he states that the Cuyuna Range could produce 75 per cent of the manganese that is consumed in the steel-making trade for many years."

What I did say was:

"I believe that if this industry was protected so that there would be a sale for the ore, that this country is capable of producing 75 per cent of the manganese that is consumed in the steel-making trade of this country and would be able to do so for a great many years."

I assume that *Engineering and Mining Journal* wishes to be fair in this matter and that it does not intentionally misquote.

I refer you to "H. R. 7456, Schedule 3, Metals and Manufacturers of." Hearing before the Committee on Finance, United States Senate, Sixty-seventh Congress, First Session, page 1,910, sixth paragraph, which gives my exact words.

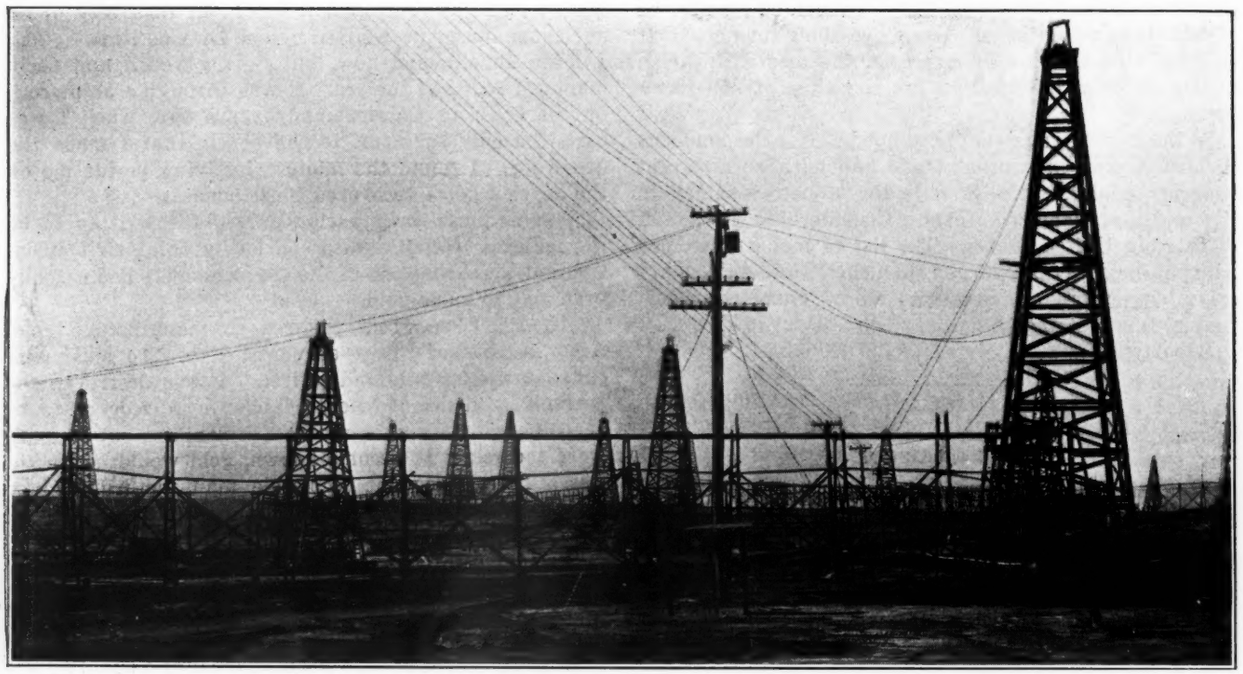
I would appreciate it very much if you would correct the statement that appeared in yours of the 17th, and give my statement in connection with this matter fair publicity. GEORGE H. CROSBY.

Duluth, Minn.

There Was No "By The Way" Page in That Issue, and We Feared the Letter Would Not Keep!

I should like to draw your attention to what I hope may prove to have been an error on your part. In the *Engineering and Mining Journal* of Aug. 27 you printed a letter from Mr. L. Maitland Leo under the heading "What Others Think." Surely you must have intended to locate this gem with others of its class in the "By The Way" column? Otherwise its publication by a reputable journal unaffiliated with Mr. W. R. Hearst is extremely hard to understand. Someone who does not personally know the author of this diatribe might possibly take it seriously. W. H. HANNAY.

Trail, B. C.



VIEW OF SULPHUR-MINING PLANT, SHOWING RESEMBLANCE TO OIL WELLS

The Gulf Coast Sulphur Industry

A Sketch of the Development of Louisiana Sulphur Deposits, Which Have Displaced Sicily as the Leading Producing Area—Manufacture of Sulphuric Acid Consumes Greatest Amounts of Sulphur and Is Vital to the Industry

BY ALBERT G. WOLF
Written for *Engineering and Mining Journal*

SULPHUR, one of the most widely used elements found free in nature, a part of a vast number of common manufactured articles or a necessary reagent in their production, essential to almost every industry in the complex organization of our modern civilization, is a substance about which the average person has only meager and hazy knowledge. Ask ten persons where sulphur comes from, and at least nine of them will reply, "from volcanoes," or "from Italy," and ask the same ten what are the chief uses of sulphur, and more than likely all will say, "matches, medicine, and fumigating."

FIRST AMERICAN SULPHUR COMPANIES ENCOUNTERED MANY DIFFICULTIES

The first discovery of a large deposit of sulphur in the United States was made at Sulphur, Calcasieu Parish, La., in 1869, by the Louisiana Petroleum & Coal Oil Co., in boring for oil. From that time until 1892 many attempts were made by shaft sinking to reach the sulphur, which lay 500 to 600 ft. below the surface and was overlaid by thick beds of quicksand. Some of the companies which engaged in this work were the Calcasieu Sulphur & Mining Co., the Louisiana Sulphur & Mining Co., and the American Sulphur Co. All attempts were failures, because of the insurmountable difficulties presented by the quicksand and poisonous gases, the latter taking a toll of five lives in the last effort to extract the mineral by direct means.

About the time that it appeared impossible to mine the sulphur from this wonderfully rich deposit, Herman Frasch, a chemist for the Standard Oil Co., took up the study of the problem, conceived the idea of melting the sulphur in place by means of superheated water, and obtained his first patent in 1891. Frasch organized the Union Sulphur Co., and after overcoming many obstacles, including a misunderstanding of the very nature of the sulphur deposit he intended to work,[1] and the drilling of several wells in barren territory, the first well was tested in January, 1895, and a little sulphur was brought to the surface. During 1896 a production of two or three thousand tons was made, and the total output up to 1898 was only 4,500 tons.

USE OF FUEL OIL MADE FRASCH PROCESS PRACTICABLE

Although the process was technically a success, the high cost of fuel (coal from Alabama) used in heating the water threatened commercial failure. Opportunely, in 1901 Captain A. F. Lucas discovered a great source of cheap fuel in the crude oil of the Spindle Top field, near Beaumont, Tex., and once more the Union Sulphur Co. began operations. The first production of note was made in 1903, when 23,715 tons was extracted.

[1]For a complete description of the coastal salt domes in which sulphur occurs see the following references: "Oil Prospecting in the Gulf Coast Country," by W. G. Matteson, *Bulletin* of the American Institute of Mining Engineers, February, 1918; "Origin of the Gulf Coast Salt Domes," by G. Sherburne Rogers, *Economic Geology*, September, 1918; "Gulf Coast Salt Domes," by Albert G. Wolf, *Colorado School of Mines Magazine*, September, 1920.

The production of the Union Sulphur Co. since then is shown in the following table:

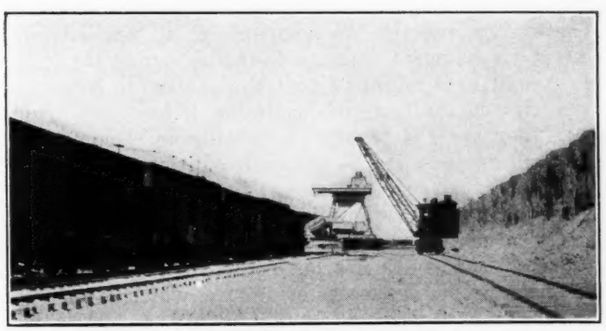
	Tons		Tons
1903	23,715	1911	204,220
1904	79,187	1912	786,605
1905	218,950	1913	478,565
1906	287,590	1914	804,470
1907	185,882	1915	379,885
1908	367,896	1916	383,465
1909	270,725	1917	575,130
1910	246,510	1918	978,700

Previous to the large-scale production from our coastal deposits, Sicily was the largest producer in the world, followed by Japan. A few figures show clearly what happened to the Sicilian sulphur trade. The total exports from Sicily to the whole world fell off from 450,917 metric tons in 1912 to 136,991 metric tons in 1919, and to the United States from about 200,000 long tons in 1903 to practically nothing in 1919.

Sicilian Competition Eliminated

For about ten years prior to 1906 nearly all the sulphur mined in Sicily was handled by the Anglo-Sicilian Sulphur Co., a British corporation which at one time controlled the sulphur market of the world. When, in 1916, this agreement was about to expire, the Italian government sent a commission to the United States to investigate this American sulphur industry, which was making such invasions upon its cherished monopoly. Baldacci, an engineer, reported that Louisiana sulphur could be produced for 18 lire and sold anywhere in the United States for 40 lire, whereas the Sicilian mineral sold for 80 lire at the place of storage and 125 lire in the United States.

In a final and frantic effort to withstand American competition, the Italian government passed a law Aug.



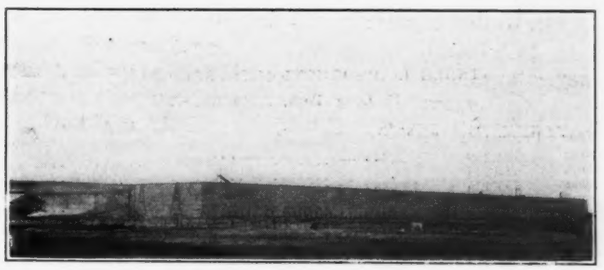
LOADING BOX CARS WITH SULPHUR BY MEANS OF LOCOMOTIVE CRANE AND BOX CAR LOADER. SULPHUR VAT TO RIGHT

1, 1906, forming all producers of sulphur in Sicily into a "Consorzio" for a period of twelve years, to sell sulphur for the common account of its members. An ultimatum was sent to the Union Sulphur Co. to keep its product out of European markets, and upon refusal the Sicilian trust attempted to "dump" sulphur upon the American market. This move was met by the Louisiana company in a reduction of price from $22 to $19 per ton, which the foreign organization could not meet, and practically no more Sicilian sulphur was shipped to America.

Captain Lucas not only was the first to discover oil in the coastal salt-dome formations, but was the first to drill at Bryan Mound, Brazoria County, Tex., where he discovered a large deposit of sulphur in a formation similar to that at Sulphur, La. This work was done for the J. M. Guffey Petroleum Co. No oil, at least none in commercial quantity, was found, and no attempt was made at that time to mine the sulphur. Later, E. F. Simms, of Houston, Tex., obtained an option to purchase the ground.

Frasch Patents Expired in 1908

In 1908 the Frasch patents, under which the Union Sulphur Co. operated, expired, and the practical monopoly of the sulphur business in this country enjoyed by that company legally expired with them. It was not until 1911, however, that steps were taken to form a company to work the Bryan Mound deposit. A little later, July, 1912, the Freeport Sulphur Co. was organized, and on Sept. 30, 1913, the Freeport Texas Co., the holding company of the Freeport Sulphur Co. and allied interests, was chartered.



VAT CONTAINING SEVERAL HUNDRED THOUSAND TONS OF SULPHUR

The first plant of the Freeport Sulphur Co. pumped sulphur on April 18, 1912, but no substantial amounts were extracted until 1916. In 1917 the maximum production was made, more than half a million tons. In 1921 the steaming plants were all shut down on account of the general business depression.

Big Hill, Matagorda County, was one of the domes drilled immediately after the discovery of oil at Spindle Top, and oil and gas were found. This stimulated drilling, and between 1901 and 1904 oil was produced, variously estimated between 200,000 and 500,000 bbl. Though the oil field was soon exhausted, sufficient evidences of sulphur were found to cause the organization in later years of a sulphur company to explore this deposit. The first company, known at the Gulf Sulphur Co., was formed in December, 1909, after test drilling had proved to the promoters that a sufficiently large sulphur deposit existed to insure the success of the enterprise. For the next few years this company was practically dormant except for the purchase of land. In 1916 a new drilling campaign was started, and in less than two years from the beginning of this operation a sulphur deposit containing over 10,000,000 tons had been developed.

Texas Gulf the World's Largest Producer

In July, 1918, the Texas Gulf Sulphur Co., the present operating company, was organized, construction was started in August, 1918, and with the aid of priority rights from the Government on account of the demand for sulphur for war purposes, the plant was completed and the first sulphur produced in March, 1919. The steam-boiler plant of 10,000 hp. was considered of sufficient capacity to produce 1,000 tons of sulphur daily, but more than this was made during 1919, and a total of over 800,000 long tons in 1920. The present production is over 3,000 tons daily, making this the largest sulphur-mining company in the world.

The following table, adapted from "Mineral Industry of 1919," shows the tonnage of sulphur produced in the United States and throughout the entire world. The tonnages here are expressed in long tons of 2,240 lb., the standard unit of weight in the sulphur business in this country, instead of metric tons as in "Mineral Industry." The sudden increase of production in 1916 is due to the entrance of the Freeport Sulphur Co. as a producer. The figures for 1919 and 1920 are not yet completely available, but those for 1919 will probably not exceed the figures for 1918, because the Union Sulphur Co. was shut down during the greater part of that year and the next, whereas the figures for 1920 may do so, because the Texas Gulf Sulphur Co. took the leading place that year as a producer.

It should be added here that the three coastal fields produced more than 99 per cent of all the sulphur mined in the United States:

TABLE I. PRODUCTION OF SULPHUR

In Long Tons, 2,240 Lb.

Year	World Production	U. S. Production	U. S. Exports	Value	U. S. Imports	Value
1902	544,259	7,445	.....	(About)	.....	.....
1903	621,065	35,097	.....	.....	200,000	.....
1904	755,126	193,482	.....	.....	.....	.....
1905	817,485	214,989	.....	.....	.....	.....
1906	832,590	293,984	.....	.....	.....	.....
1907	789,241	307,790	.....	.....	.....	.....
1908	816,332	307,760	.....	.....	.....	.....
1909	804,690	298,213	.....	.....	.....	.....
1910	775,286	255,596	.....	.....	.....	.....
1911	764,358	242,408	.....	.....	.....	.....
1912	773,436	303,655	.....	.....	.....	.....
1913	793,645	311,778	.....	.....	.....	.....
1914	863,143	342,001	98,163	$1,807,334	25,336	$448,490
1915	846,412	294,407	37,271	724,679	26,367	472,458
1916	1,184,561	766,870	128,755	2,505,857	22,456	404,784
1917	1,528,691	1,120,429	152,736	3,500,819	1,010	29,340
1918	.....	1,266,767	131,092	3,626,638	82	95,242
1919	.....	.....	224,712	6,325,552	103	8,633

TABLE II. BASIC INDUSTRIES AND CHIEF USES

	In per Cent		In per Cent
Agricuture	8.8	Elastic	
Fertilizers		Sheet rubber	
Fungicides		Miscellaneous rubber goods	
Insecticides		Sulphur dioxide	25
Carbon disulphide	3.1	Bleaching	
Fire extinguishers		Explosives	
Insecticide		Fumigants	
Poison (for pests)		Paper manufacturing	
Solvents		Photography	
Direct use	2.8	Sulphuric acid	52
Cements		Chemicals	
Fumigating		Explosives	
Medicine		Fertilizers	
Sulphuring		Galvanizing	
Rubber industry	8.3	Petroleum industry	
Belting		Steel industry (pickling)	
Ebonite		Sugar industry	

TABLE III. COMMERCIAL APPLICATIONS OF SULPHUR

Acids, organic and inorganic
Alcohol
Alum manufacture
Aniline
Antichlor
Artificial silk
Belting
Binding medium
Bleaching
Celluloid
Cements
Chemicals (miscellaneous)
Chlorine manufacture
Dyes
Dying
Ebonite
Elastics
Explosives
Fabrics
Fertilizers
  Per se
  In composts
  Artificial
Films, moving picture
Fire extinguishers
Fumigating
Fungicide
Galvanizing
Glass
Glue
Glycerine
Hose
Insecticide
Lithopone
Medicine
Metallurgical work
Paints
Paper
  News
  Parchment
  Cheap print
Petroleum industry
  Motor fuel
  Lubricating oil
  Liquid fuel
  Illuminating oil
  Solvents
  Special products
Photography
Plastics (wood pulp)
Poison (rat and other)
Preparation of organic substances
Preservative (food)
Reagent, laboratory
Refrigerating
Rubber industry
Sheet rubber
Shoe polish
Soap
Sodium carbonate
Sodium thiosulphate
Solvent
Steel pickling
Storage batteries
Sulphuring
Tanning
Textiles
Tires
Water purification

The uses of sulphur are so varied that a complete description cannot be given herewith but in Table II are shown the percentages of sulphur used in the United States in different basic industries, with some of the principal subdivisions under each, and in Table III a list, alphabetically arranged, of the various uses to which sulphur is put, or the different articles in the manufacture of which sulphur is essential. There is a little repetition in this table, but it serves to point out more clearly the very important part sulphur plays in our every-day life. Tables II and III have been remodeled from a chart in "Recent Advances in the American Sulphur Industry," by Raymond F. Bacon and Harold S. Davis, American Institute of Chemical Engineers, December, 1920.

Dangers and Inefficiency of the "Ragtown" Community

Unsanitary conditions in the average mushroom oil camp or boom oil town, often referred to as a "ragtown," invite the visitation of a costly fire or epidemic declares C. P. Bowie, petroleum engineer, in Technical Paper 261, "Oil-Camp Sanitation," published by the U. S. Bureau of Mines. Such communities usually have no water supply, or a wholly inadequate one. Garbage and decaying vegetable matter, tin cans, old rags and scrap paper are laid generally in small heaps about temporary structures or strewn promiscuously over vacant lots. Flies swarm in legions, and the atmosphere reeks with offensive odors.

Many oil men employ the contract system of drilling, which almost eliminates the tendency of companies to build camps or small towns over which they may exercise personal supervision as to housing and sanitation. The system relieves the company of all responsibility except its financial obligations to the contractor.

Though it is admitted that the sanitation conditions in such communities are deplorable, it has been argued that they are the results of extraneous circumstances and will be remedied as soon as conditions become normal, but experience has shown that so-called "normal" conditions are never attained until such a community has been visited by costly fires and epidemics. In fact, "normal" conditions are not established until the field has been proved a success or failure, which often takes months or even years.

The responsibility for the betterment of such conditions plainly belongs to the state governments; broadly speaking, all the states have legislation adequate to cope with these exigencies. The enforcement of the laws, however, too often is left to the community itself, and rests in the hands of a few men, who either think that they cannot afford to run the risk of antagonizing their neighbors by the enforcement of ordinances, or are so engrossed in business that they are indifferent to the responsibilities intrusted to them. Therefore, the neglect of those in authority to meet these responsibilities brings hardship and unnecessary misery to a class of migratory workers who may be especially susceptible to the influences of social unrest.

The employer is also a sufferer. He meets a material loss through the "soldiering" of discontented workers, petty strikes, and an enormous turnover in his force of laborers.

Remedial measures recommended for the amelioration of faulty sanitation conditions in oil camps are given in the paper above mentioned.

Mine Blacksmith Shops

A Description of the Way in Which a Small Shop Can Be Enlarged By Successive Stages To Keep Pace With an Increasing Scale of Operations—Future Requirements Should Be Considered at Outset

BY R. J. DAY
Written for *Engineering and Mining Journal*

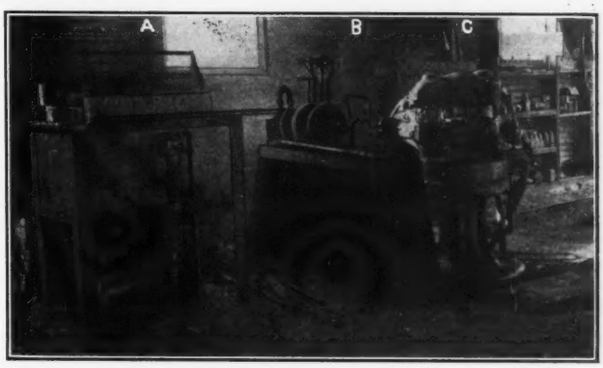
WHILE ON A BUSINESS TRIP to some mines in Arizona, I received instructions to visit as many blacksmith shops as possible and to make sketches showing the location of the various machines, particularly rock-drill sharpeners, and study the sequence of operations required for sharpening drill steel. The object in view was the arrangement of a series of drawings, whereby expansion of the blacksmith shop could be made with the minimum amount of rearrangement of the machines already in place; if possible, making it unnecessary to stop work at any time during the period of expansion to change the location of the equipment already installed.

In accordance with these instructions, blacksmith shops of mines under development, and shops of contractors, where only one sharpener unit was required to keep the drill steel in proper condition, were visited; also blacksmith shops of mines, such as the United Verde Copper Co., at Jerome, Ariz., where six or more sharpeners are in operation. I was therefore enabled to obtain information pertaining to the work in both large and small shops.

As the essential duty of the mine blacksmith shop is to keep drill steel in proper condition, the equipment of particular interest is that required to perform this work. The equipment generally used in modern shops for this purpose is: An oil furnace for heating the drill steel to proper forging temperature; a pinning device for opening the hole in the hollow drill steel when it becomes closed during the sharpening operation or from other causes; a drill-sharpening machine with the necessary dies, dollies, forming blocks, and other accessories; and a cooling tank, for use when tempering the drill bits and shank ends of the drill steel.

The oil furnace may be of any standard make of suitable size to meet the requirements. The furnace suggested for use with the proposed arrangements shown in Figs. 4, 5, 6, 7 and 8 is of the double-opening type; that is, steel may be inserted in the heating chamber from either side of the furnace. If such a furnace is installed, one furnace can be used for two sharpening units, as shown in the proposed arrangements. The furnace used, however, should have an opening of sufficient length, so that twelve to fifteen or more steels may be inserted in the heating chamber at one time. This will allow for a continuous supply of heated steels for the sharpening machine and eliminate any loss of time that may otherwise occur through necessity of waiting for the drill steels to reach the proper temperature for forging.

The pinning device is a comparatively new machine on the market, but its merits are readily recognized and, owing to the fact that the work is speeded up considerably by its use, it has many earnest advocates wherever it has been installed. This machine is a device in which the heated, hollow drill steel is held securely in a vise, a pin being then forced into the hole in the steel the required distance and withdrawn, the operation being completed so quickly that the damage done to the pin on account of its coming in contact with the hot steel is negligable. The means of forcing the pin into the hole in the steel and withdrawing it varies according to the make. Some machines accomplish the result by applying pressure alternately to opposite sides of a piston, to which is attached a piston rod provided with a chuck for holding the pin. Another popular means involves an air-hammer action, which drives the pin into the hole in the hollow steel, an arrangement being provided so that when the pin has been driven into the steel the required distance, the hammer action can be reversed and the pin withdrawn.



DRILL-SHARPENING UNIT, BLACKSMITH SHOP OF UNITED VERDE EXTENSION MINING CO., JEROME, ARIZ.

The drill-sharpening machines, although differing somewhat as to appearance, have in general the same characteristic features of operation. The heated steel is held firmly in a die (of the form and size required by the sectional shape and size of steel used) by means of an air-operated vise. The die is provided with a cone-shaped cavity wherein the hot steel is upset by means of a dolly, which is driven against the heated end of the steel by an air-actuated hammer. This operation causes the end of the steel to take the shape of the frustum of a cone. The wings of the bit are then formed in a set of forming blocks furnished for the purpose. The operations of upsetting the steel and forming the wings of the bit are repeated until the bit is brought to the proper size and shape. When forming new bits it may be necessary to repeat the upsetting and forming operations several times.

When resharpening bits, the operations are the same as when forming new ones, with the exception that it is only necessary to upset the steel sufficiently to bring the bit up to size and resharpen the cutting edge. The cutting edge is formed during the upsetting operation by means of a V-shaped groove cut in the face of the dolly.

The above description covers only the making and resharpening of the drill bit, but equipment has been developed for forming all of the various types of shanks which are in general use. The forming operations are more or less similar, consisting of upsetting the steel in a die of the proper construction and forming the lugs, collars and other parts, until the shank of the desired shape is obtained.

The cooling tank is used for quenching the steel during tempering. The tank generally consists of a watertight box, provided with necessary inlet and overflow pipes. A grating, with provisions for holding the same the proper distance below the surface of the water, is generally provided. This insures that the bit and shank ends will be quenched to the desired distance back from the end of the steel.

In the description of the proposed arrangement of the drill-sharpening shop of the United Verde Copper Co. shown in Fig. 2, and also of the proposed arrangements shown in Figs. 4, 5, 6 and 7, mention is made of a revolving rack for dull steels. This rack should be so constructed that the steel will be held in a vertical position. This will permit of the storage of the maximum amount of steel in the minimum space. The object of having the rack revolve is that the steel may be brought as near as possible to the helper whose duty it is to heat the steel in the oil furnace, thus eliminating the necessity of his walking around the rack to secure the desired steel.

A description of the miscellaneous equipment such as forges, steam hammers, and drill presses is considered unnecessary. These machines are in such universal use that nearly every one is familiar with their design and operation. They should be selected only after careful consideration of the requirements, and should be such that they will satisfactorily meet all demands that may be made upon them.

Present and Proposed Installation Described

To understand the requirements of the mine blacksmith shop better, it may be advisable to consider some of the installations already in operation, and others that were contemplated by some of the copper mining companies. With this in view, the arrangement of the equipment in the blacksmith shops of the United Verde Extension Mining Co., at Jerome, Ariz., and the Copper Queen Consolidated Mining Co., at Bisbee, Ariz., is shown; also the arrangement of the equipment of the proposed drill-sharpening shop of the United Verde Copper Co., at Jerome, Ariz., which was being considered when I visited that plant.

In Fig. 1 is shown the arrangement of equipment in the blacksmith shop of the United Verde Extension Mining Co. at the time of my visit. The machines and other equipment consisted of the following (the italic letters refer to Fig. 1):

A-A1-A2,	oil furnaces	*I,* 600-lb. steam hammer
B-B1,	pinning devices	*J,* drill press
C-C1-C2,	drill sharpeners	*K,* threading machine
D,	emery wheel	*L,* cooling tank
E,	work bench	*M,* rack for dull steel
F,	foreman's desk	*N,* face plate
G,	anvil	*O,* rack for sharpened drill steel
H,	open forge	

Also such tools and stands for supporting the long drill steels as are necessary.

The sharpening unit which was in active use is shown at *A1-B1-C1.* The unit shown at *A-B-C* is held in reserve. The sharpener shown at *C2* is a Sullivan machine, and was not in active use, with the exception that the vertical hammer (used for forming the wings on the drill bits) was being used for light forging work.

The dull drill steel was brought into the shop in mine cars running on the track shown at *X,* and was sorted according to size of bit, and stored in the rack for dull steel shown at *M.* The dull drill steel was thus within easy reach of the man whose duties were to heat it in the oil furnace, shown at *A1;* pin the bits of the hollow drill steel with the pinning device shown at *B1,* and then pass the heated steel to the sharpener operator, who resharpened the dull bit or formed a new bit on the steel.

After the sharpening operation was completed, the drill steel was deposited on the floor, near the oil furnace shown at *A2,* where it was within easy reach of the man in charge of the tempering. The steel was then reheated in the oil furnace shown at *A2* to the proper temperature for tempering and quenched in the cooling tank shown at *L.* The drill steel now ready for use again was stored in the rack for sharpened steels shown at *O,* where it was kept until wanted.

Although this description deals with the forming or resharpening of the bit ends of the drill steel, it is understood that when it is necessary to form shanks on new steel, the work is done along the lines previously outlined in the description of the drill-sharpening machine.

The rest of the equipment listed was sufficient to handle all of the miscellaneous work which shops of this kind are expected to do.

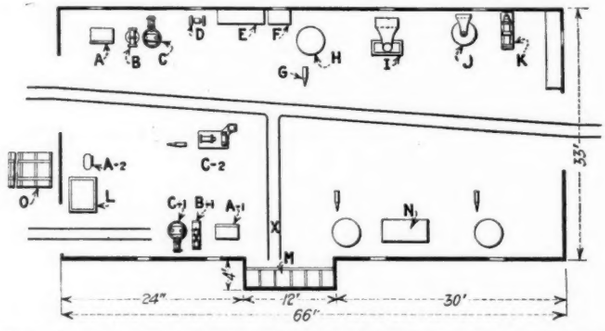


FIG. 1. ARRANGEMENT OF EQUIPMENT IN BLACKSMITH SHOP OF UNITED VERDE EXTENSION MINING CO.

It is probable that some changes have been made in the arrangement of this shop. The foremen in charge of such shops are generally trying to increase the efficiency of their departments and make such improvements from time to time as may be suggested.

Proposed Shop of United Verde Copper Co.

As stated before, one of the essential duties of the mine blacksmith shop is the keeping of the drill steel in proper condition. This fact was realized by those in direction of the management of the United Verde Copper Co., with the result that they had plans under way at the time of my visit for a shop in which drill sharpening would be the only consideration. The arrangement that they were considering at that time is shown in Fig. 2. It will be noted that it was the intention to install six sharpening units. As all of these units were to be identical, a description of any one of them will serve for all. Each unit was to consist of the following: A revolving rack for dull steel shown at *A*; an oil furnace for heating the steel, shown at *B;*

a pinning device for opening the hole in the hollow steel, shown at *C;* and a drill sharpener, shown at *D.*

It was the intention to bring the dull drill steel into the shop in a mine car or on a truck provided for this purpose, running on the track *X*, and place it in the dull-steel rack *A*, where it could be easily obtained by the helper, who would heat it to the proper forging temperature in the oil furnace *B;* the helper would then pin the steel in the pinning device *C*, and pass the heated steel to the sharpener operator, who would sharpen it in the drill sharpener that is shown at *D.*

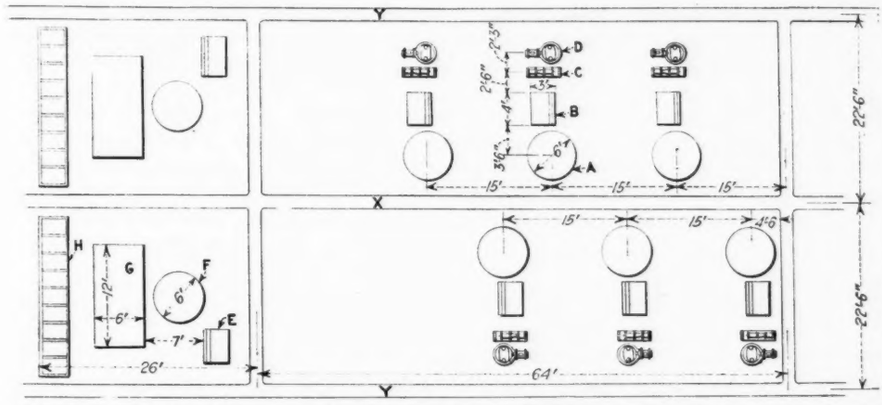


FIG. 2. ARRANGEMENT OF EQUIPMENT IN PROPOSED DRILL-SHARPENING SHOP OF UNITED VERDE COPPER CO., JEROME, ARIZ.

When the steel had been properly sharpened it was to be placed on trucks running on the track *Y* and taken to the tempering department, where it would be properly tempered by heating it to the proper temperature in the oil furnace, shown at *E*, and then quenching in the cooling tank shown at *F*.

When the steel had been properly tempered, it would be placed on the sorting table shown at *G*, and sorted in regard to gage (size of bit) and length, and then placed in the steel racks shown at *H*, where it would be kept until it was required at the mine.

It will be noted that when the requirements are sufficient to keep six sharpener units in operation, each unit can be used for sharpening one particular gage of bit, making it unnecessary to change the equipment in the sharpener, as in smaller installations where one or two units must sharpen all of the steel used. The various units should be so spaced that there will be no interference when the longest steels are being worked upon.

I am not in position to say positively that the installation described above was made, but it is shown here to illustrate the plans as formulated, and will be used as the basis of the proposed arrangements which will be shown and described later.

Another installation which may be of interest is that of the Copper Queen Consolidated Mining Co., at Bisbee, Ariz., shown in Fig. 3. The main equipment in this shop consists of the following:

A, racks for finished steel
B, racks for dull and sharp picks
C, storage space for new steel
D, tool racks
E, forge
F, cooling tanks
G, drill sharpener
H, portable pinning device
I, air hammer
J, work bench
K, emery wheel

Also such tools, stands, anvils and other devices as may be required.

It will be noted that the arrangement of this shop is very different from the shops previously described, particularly the arrangement of the sharpening units, of which there are three. One of the most noticeable features is the arrangement of the pinning device, which is portable, being mounted in such manner that the location can be easily changed and the device moved to the most convenient place for operation.

The proposed arrangement of mine blacksmith shops described in the following are the result of information obtained during the trip mentioned, and are based on the system of work then in effect at the United Verde Extension Mining Co., at Jerome, Ariz., and the arrangement of equipment as shown in the layout of the proposed drill-sharpening shop of the United Verde Copper Co. in Fig. 2. The system referred to consisted of having two men for each sharpening unit, a sharpener operator and a helper. Each unit consisted of an oil furnace of sufficient size to take fifteen or more drill steels, a pinning device, and the drill-sharpening machine.

It was the duty of the helper to heat the steel to the proper temperature for forging, open the hole in the hollow drill steel by means of the pinning device, and pass the steel to the sharpener operator, who formed

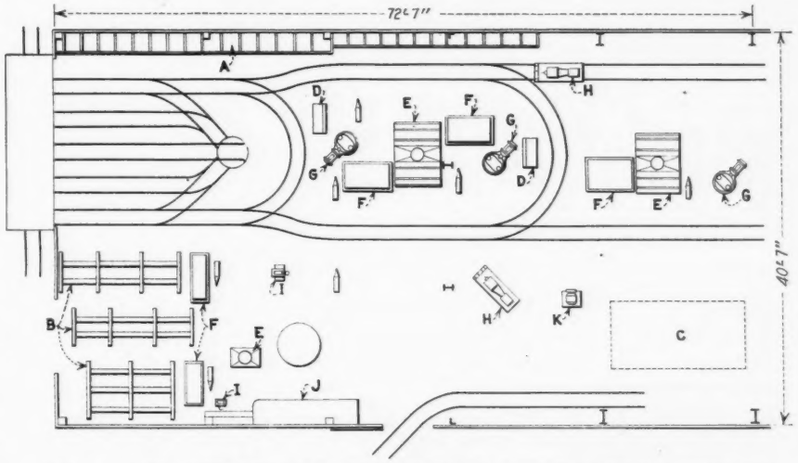


FIG. 3. ARRANGEMENT OF EQUIPMENT IN CENTRAL DRILL SHOP OF COPPER QUEEN CONSOLIDATED MINING CO., BISBEE, ARIZ.

or resharpened the bit. By this method it is possible for two experienced men, using one sharpening unit, to resharpen from 600 to 700 drill steels per shift of eight hours.

Probably a better idea of the system described above and of the location of the equipment may be had by referring to the accompanying photograph, which shows one of the sharpening units at the shop of the United Verde Extension Mining Co. The oil furnace is shown

at *A*, the pinning device at *B*, and the drill sharpener at *C*.

It has been found that by pinning the hole in the bit of the hollow drill steel before resharpening the bit, the hole will remain open after the bit has been resharpened to serve all of the purposes sufficiently for which it is intended. The work will also be speeded up considerably. If the steel is pinned after the bit has been resharpened, it will be necessary to return to the drill sharpener and gage the bit to size, owing to the fact that when the pin is forced into the steel it causes the bit to expand and become oversize. The operation of resizing the bit is eliminated by the method described above, as the steel is brought to the desired size during the resharpening operation.

It is probable that the first installation will consist of one sharpening unit, which will resharpen all of the steels required for a mine under course of development, and such other equipment as may be necessary to take care of the work which a shop of this nature is called upon to do.

The proposed arrangement of a shop of this size is shown in Fig. 4. The equipment shown consists of the following:

A, emery wheel
B, drill press
C, anvil
D, forge
E, drill sharpener
F, pinning device
G, oil furnace
H, cooling tank
I, revolving rack for dull steel
J, rack for sharp steel

Also such stands, tools and paraphernalia as may be necessary.

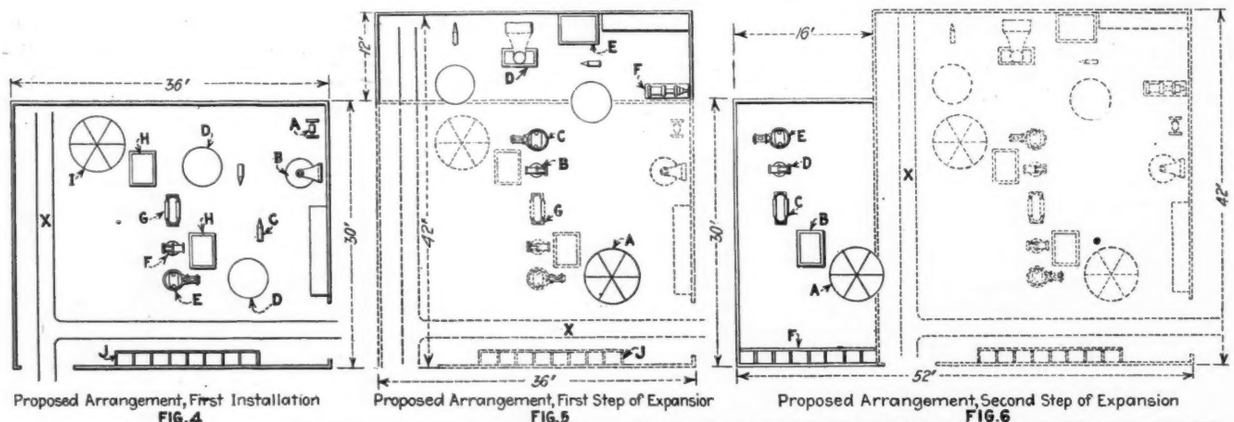
This equipment will require a building of approximately 30 ft. x 36 ft. The dull steel can be brought into the shop on a mine car or truck running on the track shown at *X*, and placed in the revolving rack for dull steel shown at *I*. It will thus be within easy reach of the helper, who heats it to the proper forging temperature in the oil furnace shown at *G*, pins the bit in the pinning device shown at *F*, and passes the steel to the sharpener operator, who sharpens the bit in the drill sharpener shown at *E*.

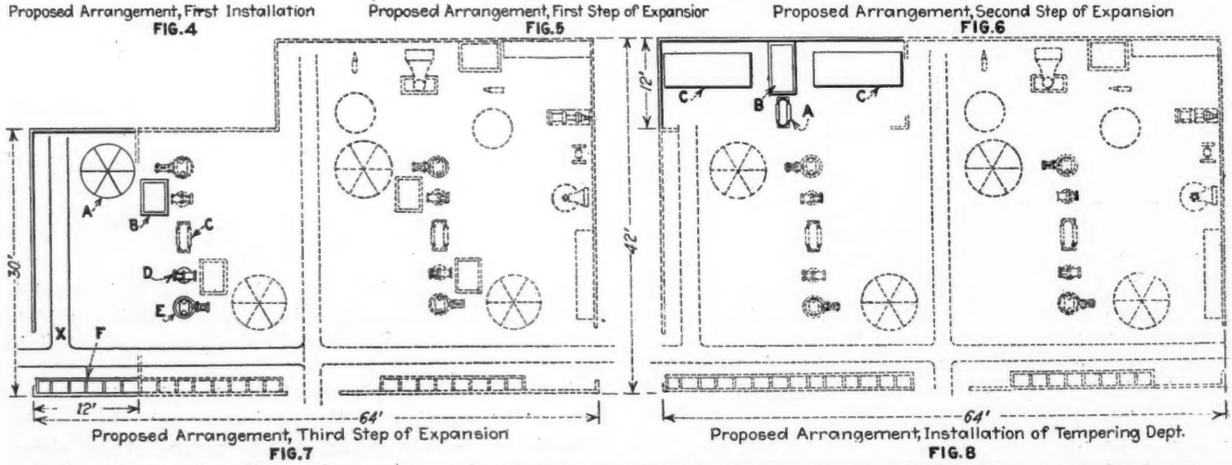
After the steel has all been sharpened it is reheated in the oil furnace *G* to the proper temperature for tempering and quenched in the cooling tank shown at *H*. It can then be stored in the storage rack for sharp steels shown at *J*, where it is easily obtainable when wanted. The equipment shown in this arrangement should meet all of the requirements of a small mine.

In the succeeding layouts, the preceding arrangement will be shown in dotted lines, so the expansion or new installations can be readily identified, only new equipment or such of the old equipment as it was necessary to move being shown by full lines.

First Expansion

Fig. 5 shows the first step in the expansion of the shop made necessary by the demand for more sharpened drill steel demanded by the increased scale of operations. The building is enlarged by the addition of a 12-ft. extension along one side. This will permit the transfer of the two forges shown at *D*, Fig. 4, to this new section as shown (in. Fig. 5), and, by so doing, room will be made for the installation of another sharpening unit as shown at *A-B-C* in Fig. 5. The same sequence of operations in the sharpening of drill steel, as was previously described, is employed here; that is,





FIGS. 4, 5, 6, 7, 8. SUCCESSIVE LAYOUTS ILLUSTRATING GROWTH OF MINE BLACKSMITH SHOP TO KEEP PACE WITH INCREASING SCALE OF OPERATIONS

the dull steel is delivered by means of car or truck running on the track *X*, and placed in the dull-steel rack shown at *A;* the steel is heated in the oil furnace *G* (which is the same one shown in the first installation, this arrangement being possible if the double-opening furnace previously described is used). The steel is then pinned in the pinning device, shown at *B*, and sharpened in the drill sharpener *C*. After the steel has been tempered and sorted, it is stored in the rack shown at *J*, until required.

It will be noted that the miscellaneous equipment has been augmented by the addition of a steam hammer shown at *D*. A hammer of about 600 lb. should be sufficient to meet the demands necessitating the installation of such a tool.

A cooling tank and a threading machine have also been added as shown at *E* and *F*. This miscellaneous equipment should be sufficient to meet all requirements for some time to come, so that, in the following proposed arrangements, only the increasing of the drill-sharpening equipment will be considered.

Second Step of Expansion

Fig. 6 shows the next step in the expansion of the blacksmith shop. A 16-ft. extension will permit the installation of the sharpener unit shown at *A-B-C-D-E*. The same method of handling the work that has been previously described is used here. The dull steel is brought to the sharpening unit on the track *X*, which is the same as is used for the first unit installed. After the regular routine of sharpening and tempering has been completed, the sharpened steel is stored in the rack *F* until it is required.

Third Step of Expansion

The installation of the fourth sharpening unit is shown at *A-B-D-E* in Fig. 7. This installation will require the building of a 12-ft. extension to the shop as shown. As was previously described when the installation of the second sharpener unit was shown, the oil furnace supplied for use with the third unit, shown at *C*, is also used for this installation.

The handling of the dull steel is practically the same as already described. The steel is brought to the unit on a truck running on the track *X* and placed in the rack for dull steel shown at *A*. The operations of sharpening and tempering are the same as those already described. The sharpened steel is finally sorted and placed in the storage rack shown at *F* until it is required.

The blacksmith shop the arrangement of which is shown in Fig. 7 should be large enough to meet the requirements of a mine of considerable size. If it is possible to secure the right kind of experienced workmen, this shop should be able to resharpen from 2,000 to 2,400 steels per shift of eight hours. This number of steels will be reduced when it is necesary to make up new steel, this operation requiring more time than is needed in resharpening a bit that has already been formed.

It has been the intention so far to have each sharpener operator temper the steel which he has sharpened. The time required for this operation will reduce the number of steels that he could turn out per shift. It may therefore be advisable, when the shop has reached the proportions last described, to install a sorting and tempering department similar to the one in the arrangement of the proposed shop of the United Verde Copper Co shown in Fig. 2. This will place the responsibility of tempering the steel, and, in case this is not properly done, steps can easily be taken to correct the fault.

Should an installation of this kind be decided upon, a continuation of the 12-ft. extension that was built to the shop for the first expansion shown in Fig. 5 would provide space for the additional equipment required. An arrangement of installation of the equipment necessary for tempering the steel is shown at *A*, *B* and *C* in Fig. 8. One oil furnace of the double-opening type will permit of two men working on this operation. The installation of a cooling tank *B*, and sorting tables *C*, as shown, is all the equipment that will be necessary. As the operator who sharpens the steel will not have to do the tempering, the cooling tanks may be dispensed with at the various sharpener units. After the steel has been tempered it should be placed in the racks provided until required.

It will not be necessary to discuss the construction of the buildings used for the blacksmith shop. This will undoubtedly be in accordance with the construction of the other buildings. Whether it is of brick, sheet metal, or of other material is optional with those in charge of the development work.

Exceptions

There are, of course, conditions of a local character which will preclude the possibility of devising a set of progressive arrangements which will prove satisfactory in all cases. The location of the shop in relation to the mine will no doubt be a determining factor as regards the method employed in handling the dull and resharpened drill steel. The human element must also be considered, inasmuch as all men are entitled to their opinion regarding the best method of doing the work. This will prove an important factor in deciding upon the layout of the shop.

I am fully conversant with the difficulties to be encountered in trying to prepare a set of drawings which will prove satisfactory under the various conditions and in all locations. The proposed arrangements shown here are presented only with the object of encouraging more consideration of future requirements at the time of the initial installations. This may result in considerable saving of both time and expense when it is necessary to enlarge the shop.

Bureau of Mines To Test Respirators And Gas Masks

Investigators have learned that the finest particles of dust, of a size far too small to be seen by the unaided eye, are the ones that lodge in the lungs and do most damage. At present little is known of the merits of the different filters used for respirators, and workmen often prefer to protect themselves with a towel or handkerchief tied around the face. In tests to be conducted by the U. S. Bureau of Mines fine particles such as compose tobacco smoke and fine mineral dusts suspended in air will be filtered with the different materials. The relative effectiveness of the filters will be noted as well as their resistance to passage of air and tendency to clog. The information obtained may be used to design more effective dust respirators.

The tests to be made by the Bureau of Mines will be conducted by S. H. Katz, assistant physical chemist, and L. J. Trostel, junior chemist, under the direction of A. C. Fieldner, supervising chemist.

Mining as Seen by Herodotus

A Belated Review

BY SYDNEY H. BALL
Written for *Engineering and Mining Journal*

HERODOTUS was born in 484 B.C. at Halicarhassus, Asia Minor, his parents being Greeks of standing. At the time the city was under Persian rule. He received a good education, which was later broadened by extensive travel in Asia Minor, Greece, the islands of the Mediterranean, Persia, and Egypt. He is known to us through his account of the causes and battles of an earlier World War, the struggle between the Greeks and the Persians. As a background for his history, he describes most of the lands of the ancient world. Herodotus established historic chronology on a solid basis, and as a historian was impartial and broad minded. As a traveler he was, as a rule, a critical observer, although he failed in instances to discriminate between fact and fable. He was not a mining man, but mentions much of interest to mining men of the present day.

At the time, Egypt had lost its virility and was under Persian rule, and the Persian Empire itself, before his death, began to disintegrate; Athens was attempting to bring the rest of Greece under its imperial rule and Rome was a struggling young republic.

EARLY GOLD MINING IN THE NEAR EAST

Gold was mined at numerous localities, most of the mines being placers, although in India lode deposits were probably worked. The gold-producing countries include Armenia, Egypt, the Caucasus and probably other portions of Russia, India, Greece and the surrounding islands, Bulgaria, and the northwestern coast of Africa. Several of these regions do not produce gold now, and although in certain instances cheap labor permitted exploitation of gravels which would not pay at the present time, in some of the streams rich patches of gravel were probably exhausted by the ancients. Herodotus recognized that placer gold was formed by the erosion of lodes, for he states that the River Pactolus, which flows through the city of Sardis, in Asia Minor, "brings down grains of gold from Mount Tmolus." (Page 348)[1]

The Carthaginians traded with the natives of the northwest coast of Africa (page 303) for gold dust in the following manner:

> "When they arrive among these people and have unloaded their merchandise, they set it in order on the shore, go on board their ships, and make a great smoke; that the inhabitants, seeing the smoke, come down to the sea and then deposit gold in exchange for the merchandise, and withdraw to some distance from the merchandise; that the Carthaginians then going ashore examine the gold, and if the quantity seems sufficient for the merchandise they take it up and sail away; but if it is not sufficient, they go on board their ships again and wait; the natives then approach and deposit more gold until they have satisfied them; neither party ever wrongs the other, for they do not touch the gold before it is made adequate to the value of the merchandise, nor do the natives touch the merchandise before the other party has taken the gold."

Such "dumb commerce" existed on the west coast of Africa until recent times.

A number of the more important of the Grecian mines were owned by the city governments, and the profits resulting from the operation of the mines were divided among the citizens. The citizens of Siphnos, in the Ægean Sea (page 194), for example, which had gold and silver mines, after setting aside a tithe for the temple at Delphi, divided the remaining profits among themselves. The Thracians (page 371) had gold mines both on the Thracian mainland and on their own island. The gold mines of Scapte-Hyle produced normally 96,000 oz. yearly. The mines on the island itself were less productive. The total of Thracian gold production is reported to have varied between 240,000 and 360,000 oz., and as a result the Thracians escaped all taxation. Herodotus visited the mines near Coenyra Thasos, which, he says, were discovered by the Phoenicians, and, he adds, "a large mountain has been thrown upside down in the search."

One can scarcely resist referring to Herodotus' statement that the Arimaspians, who had but one eye, procured their gold by stealing it from the griffins who guarded it (page 242). Even to this legend there may be a modicum of truth, as these people lived in Siberia, presumably near the Altai Mountains, or possibly east of the Urals; in either case an auriferous region.

THE LEGEND OF THE ANTS THAT MINED GOLD

The great gold-producing countries of the time appear to have been northeastern Africa and India. From the latter, Darius is reported to have obtained an annual tribute of 432,000 oz. This probably required drawing of gold from stocks, as it almost equals the present production of India, which for the period 1917-20 has averaged 477,800 oz. The most important gold district of the peninsula appears to have been the extreme northern portion, possibly Thibet (page 214-15). In this desert region the gold-bearing gravel—and this portion of Herodotus has often been quoted—is stated to have been mined by ants which were supposed to be somewhat larger than foxes. The Indian gold seeker mounted a female camel, a male being on either side. He timed his arrival at the gold mines to coincide nicely with the hottest part of the day, at which time the ants hid themselves underground:

> "When the Indians arrive at the spot, having sacks with them, they fill these with sand, and return with all possible expedition. For the ants, as the Persians say, immediately discovering them by the smell, pursue them, and they are equaled in swiftness by no other animal, so that if the Indians did not get the start of them while the ants were assembling, not a man of them could be saved. Now the male camels (for they are inferior in speed to the females) slacken their pace, dragging on, not both equally; but the females, mindful of the young they have left, do not slacken their pace. Thus the Indians, as the Persians say, obtain the greatest part of their gold; and they have some small quantity more that is dug in the country."

As Sir Henry Rawlinson has perhaps correctly inferred, the alchemy of legend transformed the fur-clad Tibetan miners, whose gold was often stolen by bandits, into ants.

In addition to these gold deposits, India obtained

[1]References are to translations by Henry Cory, "Bohn's Classical Library," London, 1912.

some from its river gravels, and some was "dug"; the latter presumably refers to open cuts on the weathered portions of veins, or possibly to mere pits in gravel.

Did the Cyraunisians Infringe M. S.?

Off the coast of Algeria was an island, Cyraunis (probably modern Kerkenna) (page 302), in which, according to the Carthaginians "is a lake from the mud of which the virgins of the country drew up gold by means of feathers daubed with pitch." This is perhaps the first reference to oil flotation, and appears to be a flagrant infringement of certain patent rights. The quantity of gold thus illegally recovered is unknown, but, even if small, considerable damages could be claimed, as the interest alone from 450 B.C. to date would amount to a tidy sum.

Owing to the difficulty of communication in Herodotus' time, the value even of gold varied among the various people of the world, although his statement that in Ethiopia gold was so plentiful that prisoners were fettered with golden chains and that copper was the most rare of all metals must be accepted with some reserve. The Massagetæ, perhaps inhabiting what is now Bokhara, possessed gold and brass in abundance, but no iron or silver. Among the Greeks, gold appears to have been worth thirteen times as much as silver (page 212), and, strangely enough, in November, 1919, the relative value of the two metals was not appreciably different.

Ancient Philanthropist no Piker

Notwithstanding the primitive mining of the day, gold, among the kings and richer citizens, was relatively abundant, and considerable stocks of gold and silver existed. Crœsus' presents to Delphi equaled, in addition to a golden statue of considerable size, 34,200 oz. of "fine" gold and 271,200 oz. of "pale" gold. He duplicated this gift to one of the Ionian shrines, and gave perhaps half as much to other temples. His contributions to charities, as enumerated, were, therefore, something over four million dollars. In Babylon, according to the Chaldean, one of the temples contained golden thrones and tables weighing some 960,000 oz. That wealth was confined to neither the kings of the time nor the temples is indicated by the fact that Pythius, (page 422) a citizen of Phrygia, owned 2,400,000 oz. of silver and 1,597,200 oz. of gold. If these figures are to be believed, at present metal prices, this private citizen was worth about $33,000,000. As no income tax existed at the time, the wealth of this Phrygian may well have been subject to his own exaggeration, and it is probable that many of the gifts to the gods mentioned above were not solid gold.

The casting of gold seems to have been common among several of the peoples of the time, as was gilding. Crecian goldsmithing was at its height. The gold of the day varied considerably in fineness, some being referred to as "pure" gold and some as "pale" gold. Prior to coining gold, Darius is reported to have refined it "to the utmost perfection," and the purest silver of that day was that coined by Aryandes, a Governor of Egypt. The purity of gold was judged by the Persians of the time by comparing its streak with that of known pure gold. It was used for personal adornment, for coinage, and for votary offerings, nor does the judgment in its display at that time appear to be worse than that of the present day.

Silver was obtained from Thrace, Macedonia, Asia Minor, and the Grecian islands. The silver mines at Laurium (page 457), which, by the way, were worked in the sixth and seventh centuries B.C., and are still actively exploited, were the property of the city of Athens. The citizens renounced their share in the profits, and with the money a navy was built for the war with Ægina. Previously, every citizen received about 2 oz. yearly, the production of this slave-worked mine being thus well over 40,000 oz. per year. Near Lake Prasias (page 312), on the border of Thrace and Macedonia, was a mine from which Herodotus reports that there was obtained yearly by the Macedonian kings 430,000 oz. of silver. The uses of silver at that time were not different from those of the present day, and already certain silversmiths were famous, Herodotus particularly mentioning Theodorus, the Samian.

Other metals are less frequently mentioned. Iron, copper, lead, and tin were used in relatively small quantities. The people of what is now Bokhara are reported to have had large supplies of copper, and the inhabitants of what is now southern Egypt held copper as the most rare and precious of all metals. Tin was reported to come from the Cassiterides (Great Britain), (page 218), but of this Herodotus, through over-caution, is skeptical.

Mineral paints were used by many of the semi-civilized or savage people of the time for body decoration. The vermilion used by the Zaveces and the Maxyes tribes living in northern Africa may in reality have been mercuric sulphide rather than red ocher. The Ethiopians of Xerxes' army smeared half their bodies with chalk and the other half with red ocher.

Flint implements were in use by Egyptians in the preparation of bodies for embalming, and the Ethiopians of Xerxes' army used stone arrows.

Libyan Houses Were Built of Salt

Salt was obtained at numerous localities, some of it by the evaporation of sea water or that of saline lakes and some as a byproduct of oil production. In northern Africa certain of the numerous hills of rock salt were mined. It is stated that south of Gibraltar "the houses . . . built of blocks of salt, for in these parts of Libya no rain falls, for walls being of salt could not stand long if rain did fall. The salt dug out there is white and purple in appearance." (Page 300.) In the oasis of Ammon, such salt houses still exist, or did a few years ago. Sodium carbonate, obtained by the Egyptians from alkali lakes, was used in embalming. The Egyptians also produced alum, and were evidently the most advanced chemists of the time. The Ethiopians are reported to have embalmed the bodies of their dead much as did the Egyptians, and then to cover them with gypsum. "They then put around it a hollow column made of crystal, which they dig up in abundance and is easily wrought." (Page 180.) This may possibly refer to gypsum, but perhaps, after all, is nothing but glass or a glaze over the mummy case.

Engraving of agates and other semi-precious stones was one of the most admired arts of the day. Notwithstanding the fact that the Persians were at that time in commercial contact with India and that Herodotus traveled widely in Persia, it does not appear that the stones which we rank today as precious were widely used. It is probable that Indian gem mining, as an important industry, post-dated Herodotus' time and that the gems found were claimed and hoarded by the local potentates. In fact, precious stones in quantity were

only introduced into western Asia and Europe after Alexander's conquest of India, a century later. Polycrates (page 188), tyrant of Samos, however, had a true emerald, presumably from Egypt, in his seal ring engraved by Theodorus. This, on the advice of Amasis, king of Egypt, he threw into the sea as his most valuable possession, so that his good fortune might not be too complete. On the fifth or sixth day, it will be remembered, a loyal fisherman, who had caught an unusually fine fish, presented it to his king, and therein his chef found the ring. Upon this being recounted to Amasis, he declared that any one with such good luck as Polycrates could come to no good end, and, fearing international complications, he renounced his friendship.

Crystal Earrings for the Egyptian Crocodile

The shining "emerald" pillars in the temple dedicated to Hercules, at Tyre, were presumably—as are many of the other great "emeralds" of antiquity—green glass. Crystal was wrought by the Egyptians into earrings for the sacred crocodiles. The Phœnician trade in amber (page 218) from the Baltic coast had long been established, although Herodotus, as in the case of tin from Cornwall, was unwilling to assume the responsibility of sponsoring the report.

To be popular in 1921 one must, of course, address the oil world, and Herodotus showed his modernity by not overstepping this convention. The occurrence of asphalt is mentioned in Mesopotamia, southwestern Persia, the Island of Zante, Macedonia, and Cyraunis, an island off Libya. The Mesopotamian and Persian occurrences sound most up to date, and recently oil development began in Macedonia.

The bitumen used in constructing the walls of Babylon was brought down in lumps by the waters of the Euphrates River and came from what is now presumaby Hilla (the ancient Hit) (page 78). On the Island of Zante there were several pools from which asphalt was obtained, the largest being seventy feet in diameter and thirteen feet deep (page 302):

"Into this they let down a pole with a myrtle branch fastened to the end, and then drawn up, pitch adhering to the myrtle. It has the smell of asphalt, but is in other respects better than the pitch of Pieria (Macedonia). They pour it into a cistern dug near the lake, and when they have collected a sufficient quantity; they pour it off from the cistern into the jars. All that falls into the lake passes under ground, and appears again upon the surface of the sea, which is about four stades (one-half mile) distant from the lake."

Asphalt, Salt, and Oil Wells

Herodotus was perhaps the first to refer to the association of salt and oil. Regarding a well near Ardericca, at the head of the Persian Gulf, he states that "it produces three different substances, for asphalt, salt, and oil are drawn up from it, in the following manner: It is pumped up by means of a swipe, and instead of a bucket, half of a wine skin is attached to it; having dipped down with this, a man draws it up and then pours the contents into a receiver; and being poured from this into another, it assumes three different forms: the asphalt and the salt immediately become solid, but the oil they collect, and the Persians call it rhedinace; it is black and emits a strong odor" (page 398-99).

The principle of the pipe line was known, for when Cambyses, son of Cyrus, was en route to fight Amasis, King of Egypt, it is stated, in order to permit Cambyses' troops to pass over the desert region, "that the king of Arabians having sewn together a pipe of oxhides and other skins, reaching in length to the arid region, conveyed the water through it."

Operating Ventilation Doors By Compressed Air

It has only been in recent years that the proper ventilation of metal mines has received serious consideration, says E. D. Gardner, mining engineer, in Serial 2273, *Reports of Investigations*, U. S. Bureau of Mines. Increasing temperature and humidity with greater depth in some of the larger mines of the West prevented the efficient operation of the mines and made the installation of mechanical ventilation systems necessary. Doors that interfere with tramming are generally needed to control properly the mechanically induced air currents and are one of the inherent disadvantages of the system. In fact, the necessity for the use of doors in the main haulageways has discouraged the installation of mechanical ventilation in some metal mines.

A number of mining companies in Arizona are using ventilation doors which can be opened and shut mechanically by the motorman without leaving his seat or stopping his train, and thus interfere very little with the transportation of the ore. The Copper Queen branch of the Phelps Dodge Corporation at Bisbee introduced these ventilation doors and adapted them from those in use in the company's coal mine at Dawson, N. M. Other mining companies have installed the same type of door, and it is now being used in a number of districts in Arizona.

The doors at the Calumet and Arizona mine, in the Bisbee district, are representative of those in use in other mines. They are substantially built of 2-in. lumber, are air tight, are well placed and have two openings or passageways. The main door, which is used for the motor trains, is 5 ft. wide by 5 ft. high, and is opened by compressed air and closed by a counterweight. At the side of the motor door is the man door, which is 18 in. wide by 5 ft. high and is opened and closed by hand.

The mechanism for opening the main door consists of a section of 5-in. pipe about 5 ft. 6 in. long, threaded at both ends and used as an air cylinder. A piston fits in the cylinder and is attached to a 1-in. plunger rod which passes through a stuffing box at one end of the pipe. The free end of the rod is attached to a rope that goes over a pulley and is fastened to the door. A ¾-in. pipe connection from the compressed-air line is tapped into the cylinder at the packing end. When the air is turned on it forces the piston to the other end of the cylinder and thereby opens the door. The door is held open as long as the air pressure is maintained, and is closed by the counterweight and the force of the air current when the pressure is released.

Tests on Leaching Gold Ores

Gold ores containing stibnite have been leached with alkaline sulphides at the Northwest station of the U. S. Bureau of Mines. A report covering all the work done on antimony at this station of the Bureau will, it is announced, be published at a later date.

Mine Operators of Note

William J. Loring

WILLIAM J. LORING is and has been a gold miner. He successfully progressed through the stages, starting as a boy of twelve, single-jacking on a side-hill mining claim at 50c. per day, to a miner, mill man, mill superintendent, mine manager, and up through various positions of larger responsibility to his present position as director of the destinies of important mining companies. He is a 100 per cent product of the mining industry.

That industry, an active mind, an energetic body, and keen observation will find a way to advance up the ladder of success is easily demonstrated by a study of Mr. Loring's career. He was born near Half Moon Bay, Cal., on March 6, 1869. His father was a lawyer. He received a common-school education in the schools of Amador County, Cal. As a boy he became interested in the mining life which centered about his home in Amador City, to which his parents had moved.

While yet a school boy, young Loring filled in his spare time working in the mines and mills wherever he could find a job. At Plymouth, he broke ore and shoveled it into the feeders in the old Empire mill, and at fourteen he secured regular employment at this mill on the same job. So well did he fulfill his duties that his employers steadily advanced him, until he became assistant amalgamator and concentrator man, remaining at this work until the property was closed down by Alvinza Hayward, Walter Hobart, Sr., and their associates in 1888.

At the age of nineteen Mr. Loring was considered a good mill man and easily secured employment under Walter Tryon at a small mill. Later he was transferred to the Utica mill, which was under the superintendency of Charles D. Lane. He remained with the Utica company during the expansion of this company's milling facilities and eventually became mill superintendent in charge of stamp mills aggregating a total of 160 stamps. W. C. Ralston was impressed by the ability of Mr. Loring and secured his services as superintendent of the Melones mine, at Robinson's Ferry. This mine was in the beginning stages, and Mr. Loring took charge of the erection of a sixty-stamp mill and the construction of a water-power plant to operate it. Hardly had this work been completed when opportunity opened out a wider horizon for Mr. Loring. Herbert Hoover, who at that time was a partner in the English mining firm of Bewick, Moreing & Co., asked Mr. Loring to go to West Australia to take charge of mining properties. Hoover's attractive offer was accepted, and Mr. Loring left California for Australia in 1902. He first became superintendent of the Sons of Gwalia mine and rapidly put that mine into profitable operation by reducing costs, increasing ore reserves, and energizing the operating organization.

In 1903, W. A. Prichard and Mr. Loring became joint general managers for Bewick, Moreing & Co. in Western Australia. This firm was operating sixteen mines in Western Australia, and Mr. Loring was given charge of the mines under the control of the company outside of the Kalgoorlie district. In a short time other changes took place, and Mr. Loring became general manager for all of the Australian properties under the direction of Bewick, Moreing & Co. Mr. Loring soon became a partner in the firm by taking over Hoover's interest in 1908. He gave up his Melbourne office and established his headquarters in London.

In 1908, Mr. Loring went to Burma and started the development of the properties of the Burma Mines, Ltd. These properties have since become one of the great mines of the world. Since then he has traveled extensively, visiting most of the gold-mining regions of the world.

During the war, Mr. Loring returned to the United States and made his headquarters in San Francisco, where he has since remained. From this vantage ground he undertook the development of mining properties in California in which he was already interested, and turned his attention also to Nevada.

One of the first properties which he took over was the old Plymouth mine, where he had worked when a young lad at school. The reopening of this property had been started in 1911, and had been conducted under the direction of Albert Burch. Mr. Burch held an option on the property, which option was subsequently taken over by Mr. Loring and assigned to the California Exploration Co., Ltd., a company formed by Bewick, Moreing & Co.

In the war period, the attention of Western mining men was attracted to tungsten mining by the representations made of the critical need for the development and mining of war minerals. With characteristic energy Mr. Loring went into tungsten mining and organized the Pacific Tungsten Co. This company opened up and operated tungsten properties near Mill City, Nev. A mill and mining plant were erected and operations started, but the unexpected termination of the war left the enterprise without a market for its product.

The consolidation of several properties on the Mother Lode at Carson Hill, Cal., and their development into an important gold producer were successfully accomplished by Mr. Loring during the last few years. In the process of gathering together the several properties, he secured an option on the Morgan group of claims. A careful examination of the Morgan adit led to the discovery of a promising lead. This was opened up, and a rich orebody was found. Rapid development followed, and the Morgan group was purchased in 1918 for $600,000. The Melones property was next taken over under option.

Not all of Mr. Loring's mining ventures have been successful. Like other operators, he has had some failures. His successes can be ascribed in part to his practical knowledge and experience and in part to his willingness to take a chance.

Mr. Loring gets down to his office at 6 o'clock in the morning, and is as likely as not to phone his mine superintendents and be in touch with mine operations before the average business man starts to his work. He puts in a longer day than his assistants and is more likely to be found at one of his mines than at his office. Widely known among engineers and mining men and with the background of active participation in many mining activities, he is an excellent leader for the American Mining Congress, which selected him for its president in 1921.

BY THE WAY

Resolutions

The whereases of most resolutions being usually trite and tedious, we shall omit them from the following, which we offer for the consideration of the resolutions committee of the Mining Congress:

RESOLVED, That the "copper-collared" press of Arizona lay in a new stock of collars while the metal is cheap.

RESOLVED, That thirteen cents is an unlucky price for copper and that the producers skip it and ask fourteen.

RESOLVED, That the Mining Congress Convention get down to brass tacks at the start and begin its sessions at the appointed hour, instead of thirty or sixty minutes later—the copper and zinc in the tacks to come from American producers.

RESOLVED, That the speaker who insists on reading a paper already in the possession of the audience be shot forthwith, brass cartridges being used.

RESOLVED, That everyone buy something made of copper, if it is only a washing machine. This will help the Guggenheims and others as well as the wife.

RESOLVED, That a collection be taken at the annual banquet to buy shoes for the copper men during the coming winter.

Wanted—A Plumber

There was a bad leak in Los Angeles recently, something that never could or would have happened in San Francisco. They are *so* different in San Francisco. It seems that a certain dentist, running short of gold for filling teeth and becoming desperate, went out to the Santa Monica Mountains, where, probably through his being a member of the Chamber of Commerce, he discovered all the gold he could possibly want—billions of it. Fully fifty assays were made, so there is no doubt of it. According to reports, which vary just enough to dispel all doubt as to their truthfulness, he found a deposit of flour gold, assaying $59.95 per ton. It was Monday when the assays were made, otherwise it might have been $60. Anyhow the gold is packed in a ledge of shale, which may yet prove to be oil shale, that has been traced for three miles and is 1,000 ft. wide in places. Experts declare that the gold can be extracted for $2 per ton. The gold was discovered when the specimens were subjected to a heat of 480 degrees LL.D. Panning or any other process would not disclose it except the application of intense heat. The dentist sealed his lips, but, not knowing how to keep his mouth shut, which is not taught in dental colleges, he kept it open instead—wide open; and the story got out. The new discovery will shade King Solomon's mines, it is thought, or the California days of '49. It is said to be the first time a deposit of flour gold has been found under the same conditions anywhere in the world except in Russia.

This discovery is a sad blow to Messrs. Lawrie and McFadden. Why the onus of a bonus for gold producers when nature's vast storehouse in the Santa Monicas is chock full of yellow metal that can be extracted at low cost? Even the representatives from the gold districts will admit the cogency of this argument. Of course there are doubting Thomases who say it is all just some more Los Angeles bunk manufactured purely out of jealousy of the notoriety that the City by the Golden Gate has recently been enjoying.

Suggestive

The Rainbow Castle Company, of Los Angeles, has received a permit from the State Commissioner of Corporations to sell 3,000 shares of stock, 2,000 common and the rest preferred. The name of the company is attractive: it suggests the well-known pot of gold, could we find which we would straightway build us a castle in Los Angeles' wonderful air.

Out of Sight, Out of Mind

"They do say, m'son," said Cap'n Dick, "as 'ow tha cost o' livin' 'as been commin' daown, an' every naow an' again we sees a lot o' these 'ere statistics that show 'ow much it takes a man to support 'is missus an' family, pay 'is h'income tax, an' still 'ave h'enough to see one o' these 'ere movies naow an' again. But it h'appears to me that tha price o' pasty steak still 'angs pretty 'igh, an' a chap 'as to watch h'every chance 'e gets to h'economize. Coorse, naow, there's different ways o' doin' that; some 'as one scheme an' some 'as h'another. I remember 'earin' tell o' Billy Pascoe, 'oo wuz keepin' bachelors 'all near tha Meadow mine. One h'evenin', jus' as 'ee wuz gettin' supper, a 'en walked h'into 'is shack. 'Dam-me, old 'en,' sez Billy, 'Nobody seen thee come h'in, you, an' nobody's goin' to see thee go h'out.' An, m'son, they didn't."

At the Red Bird Mine

H. F. Emerson got off with both feet forward when he wrote a certain report on the Red Bird mine. One can only guess where the Red Bird is, but Mr. Emerson begins as follows:

> It is seldom that nature signals to man where its hidden treasures are to be found as plainly as here at this property, where a great intrusion has forced itself upward through the limes and shales of sedimentary origin and left this great chimney or blow-out of highly colored mineral-bearing rock beckoning and awaiting development.
>
> Here you have a most complete example of the workings of nature's laboratory, fire and water, solids and liquids, acids and alkalies, heat and cold.
>
> When this portion of the country was covered with water and the rivers had brought their muds and clays and sands from the mountain sides and deposited them in these waters, and the soft sludge of lime precipitate was in process of forming the top layers of limestone which cover this section of the country, an eruption occurred and the gases found vent in the hill or anticline on which this property is located; then a seething, boiling, bubbling mass frothed and foamed and sizzled as it was constantly forced upward by the power of the unspent fires beneath.
>
> These fires were pouring out hot gases which were being condensed by the cooling liquids above, and a tremendous chemical change took place. Rocks, pebbles, and boulders were shot upward into this mass and were squeezed and pressed into compact formation. These fragments were torn and broken from the ledge of the primary formation lying below, which in this case was porphyry carrying rich values of gold and silver. Much of this gold was carried upward in the gases and in solution and was deposited by precipitation throughout the entire mass, so that all of the limestones, the conglomerates, the shales and the porphyries are impregnated with fine gold.

An excellent start. Mr. Emerson must have been present at the birth of the Valley of Ten Thousand Smokes. It is to be regretted, however, that his imagination continues to run riot to the end of the report, so that at the end one has a complete picture of a large mill supplied from a wonderful orebody, which Mr. Emerson says he did not sample.

THE NON-METALLIC INDUSTRY

Converting Dolomite Into Magnesite

Experiments Which Were Made in an Effort To Utilize a Cheap and Abundant Eastern Limestone — Simple Calcination and Leaching an Effective Method— Product Higher in Lime Than Natural Mineral, but Compares Favorably With It

BY DJEVAD EYOUB
Written for *Engineering and Mining Journal*

PREVIOUS TO THE GREAT WAR the United States imported almost all of the magnesite used in this country. During 1913, the last normal year, 149,000 tons of magnesite was imported into the United States. Most of it came from Austria and Greece. Of course, the advent of war closed this channel. Prior to the cessation of imports, calcined magnesite sold for $20 to $25 per ton at Atlantic ports. During 1916, $65 to $70 was quoted for calcined magnesite in New York and Philadelphia. These high prices gave a sudden impetus to magnesite mining in California, and brought about the successful prospecting and production of it in Washington. At the same time it interested several New York financiers in making a research to ascertain if magnesite could not be successfully made from dolomite, a common rock in the vicinity of New York and Philadelphia.

During the latter part of 1916 I was engaged to study the problem of commercially extracting magnesium oxide and other magnesium compounds from dolomific limestones and dolomites. Magnesite in its crude state is $MgCO_3$, whereas dolomite is a double carbonate of magnesium and calcium. The problem plainly resolves itself into the elimination of the calcium. At the outset it was evident that the method of treatment should be of such character as to give a salable product at low cost. Therefore the use of chemicals should be minimized if not obviated entirely. This eliminates many chemically plausible procedures.

A study of the solubility tables for the compounds of calcium and magnesium will reveal the interesting fact that $Ca(OH)_2$ is about fifteen times more soluble than $Mg(OH)_2$.

In the laboratory where my experiments were conducted there were twenty 100-lb. samples from fifty quarries in the Westchester County, N. Y. These were marked and analyzed for CaO, MgO, Fe_2O_3, Al_2O_3, and silica. Ten of these samples were immediately discarded on account of their high silica content. A five-pound sample of each of the remaining samples was subjected to calcination at 800, 1,200, and 1,500 deg. F. The samples were crushed in the laboratory crusher so that 100 per cent would pass through ten mesh. It was found that it was not necessary to keep the rock in the oven for over fifty minutes. After calcination, the samples were dumped into galvanized-iron tanks of twenty gallons' capacity half filled with water and were vigorously mixed, with paddles improvised in the laboratory, for eight or ten minutes. The mixture was allowed to settle, and the bitter-tasting calcium hydroxide solution was siphoned out. The residue was washed with fresh water and allowed to settle for the second time. Then the precipitate was dried and exposed to various temperatures and analyzed for lime, magnesia, iron oxide, and silica.

When the results were tabulated it was clear that in the primary calcination the low and the high temperatures were yielding unsatisfactory results. After various interpolations, from 950 to 1,000 deg. F. was found the most suitable for the purpose of the investigation. At higher temperatures lime was found to make a certain percentage of insoluble compounds, and at the lower temperatures the dissociation of the dolomite was not complete. It was clear that the nearer the temperature of the water to freezing, the better would be the product.

Six of the ten samples gave satisfactory results. The product was submitted to various composition flooring houses in New York as well as to the buyers of magnesite for refractory purposes. Their approval was almost unanimous. It should be mentioned in this connection that lime over 3 per cent renders the product undesirable for the flooring business, though it is not considered detrimental for lining furnaces. The average percentage composition of the six samples referred to is as follows: MgO, 81.20 per cent; CaO, 4.10; insoluble, 13.90 per cent. It is interesting to compare this with the products marketed:

	European	Northwestern	Artificial
	In Percentages		
MgO	85.12	83.04	81.20
CaO	2.90	3.11	4.10
Insoluble	11.50	13.80	13.90
	99.52	99.95	99.20

Magnesite is one of the few articles that has not experienced serious reduction from its war-time price. It sold for from $70 to $75 during hostilities and it sells for from $60 to $65 now. These prices are for the Atlantic seaboard (f.o.b. California and Washington points it is $16 to $20 less). Owing to the tariff imposed, $10 per ton on the crude and $15 per ton on the calcined, the Grecian and the Austrian products have not been very abundant in the market.

It appears that most of the magnesite consumed in United States is used in the East, where the gigantic steel plants, large paper industries, and growing flooring businesses are situated. Yet the bulk of the magnesite used comes from the Pacific Coast. It is my belief that the large and extensive dolomite deposits of the East will in a near future be exploited for the artificial production of magnesite. The treatment charges for this could be made considerably less than the transportation charges of $16 or more from the Pacific Coast to the Atlantic seaboard.

HANDY KNOWLEDGE

Guniting at United Verde Extension

Much useful information is given in a paper describing the United Verde Extension plant and gunite methods, read by E. E. Campbell at a recent meeting of the Arizona Chapter of the American Mining Congress. Mr. Campbell said in part:

"During the period when the mine was poorly ventilated, timber repair costs were excessive, due to heavy ground and to short life of timbers. This led to experiments being carried out in the use and economy of concrete and gunite in supporting ground heretofore timbered. The results of these experiments show conclusively that, in most cases, in permanent workings either concrete or gunite can be used to far better advantage than timber. Timber has already been removed from several hundred feet of tunnels through heavy ground and these portions concreted with excellent results, at a cost of approximately twice the cost of timber repairs. Many thousand feet of timbered drifts, through lighter ground which requires supporting, have had the timbers removed and these workings have been gunited with satisfactory results, at a cost less than one-fourth that of timber repairs.

"The following is a record of cost of guniting a representative section of the Josephine tunnel, which is the big haulage tunnel on the 1,300 level.

Costs of guniting tunnel:	
Size of tunnel	10 x 10 ft.
Footage gunited	4,098 ft.
Mixture used, 1 cement to 3 sand	
Application, two coats	
Labor	$2,581.29
Cement (2,056 sacks at $1.10 per sack)	2,250.60
Sand (263 cu.yd. at $2.50 per cu.yd.)	657.50
Machinery repairs and supplies	282.84
Total cost	$5,772.23
Cost per linear foot of tunnel	$1.40
Cost per sq.ft., approximately	.046
Cost of guniting in 1,100 drifts:	
Size of drifts	6 x 8 ft.
Footage gunited	733 ft.
Mixture, 1 cement, 3 sand	
Application, two coats	
Labor	$305.62
Cement (229 sacks at $1.10 per sack)	251.80
Sand (27 cu.yd. at $2.50 per cu.yd.)	67.50
Machinery repairs and supplies	12.21
Total cost	$637.13
Cost per foot	.869
Cost per sq.ft.	.043

"The following is a record of comparative figures on shaft concreting carried on under two different contract conditions. These figures are most instructive, as they show a wide difference in results attained when the workmen participated in a bonus on the amount of completed work done and when their recompense does not depend on what they accomplish.

"During the last year the Edith shaft was concreted from the surface to the 1,400 level. The first section of this work, 575 ft., was let on the following basis: The contractor submitted an estimated cost within which he was to complete the work and receive as a bonus 50 per cent of any saving he could make on the estimated cost. The contractor was given a free hand in choosing his crew, and the men were paid current shaftman's wages. The company paid all expenses of the work, which was completed well within the estimated amount, the contractor receiving a bonus of $3,075, which amounts to $5.34 per ft. of work. The total cost per foot of completing this section, including the concreting of two stations, was $43.14.

"The remainder of the work, totaling 630 ft., was let on the following basis: Every man on the job was paid the current shaft rate, plus a bonus per shift, the amount of which depended upon the average number of feet of work completed per day for the entire job. Under this scheme the men received as bonus $2,056.50, or $3.26 per ft. of work.

"The total cost per foot of completing this section, including the concreting of five stations, was $31.35 per ft., as compared with $43.14 under the other plan.

"In comparing the two jobs, the first section has the handicap of a partly trained concreting crew, with the advantage of having only two stations to concrete and under the second scheme there was an advantage of having trained men, which advantage was offset by having five stations to concrete. The ground in both cases was practically the same.

"The following is a detailed compilation of the costs in both operations:

EDITH SHAFT CONCRETING

"Three-compartment shaft (two hoisting compartments 4 ft. x 5 ft. 6 in. and one manway and pipe compartment 5 ft. 2 in. x 5 ft. 6 in.), shaft wall containing six pipes in varying sizes.

"Shaft concreted from 1,400 level to surface, a distance of 1,205 ft., including seven stations.

"Work started Feb. 1, 1921; completed July 25, 1921.

"Work was done in two sections, first section from 800 level to surface, 575 ft. on contract basis.

"Second section, 1,400 level to 800 level, 630 ft., was done on bonus basis on footage made per day.

"The actual cost of mixing and placing the concrete in each section, not considering the preliminary cost of installing crushing plant, removing old pipe lines, placing guides and chairs in the concreted sections, was in each operation as follows:

FIRST SECTION

575 ft., including two stations.
Work started Feb. 1, 1921; finished April 21, 1921—eighty days.
Average advance 7.19 ft. per day.

Costs:	
Labor (including supervision at $10 per day)	$8,827.20
Cement (6,564 sacks at $1.10 per sack)	7,220.40
Sand and gravel (1,498.1 cu.yd. at $2.50 per cu.yd.)	3,745.25
Power used hoisting and crushing (25,380 kw.-hr. at 2c.)	507.60
Reinforcing iron (10 lb. per ft. of shaft at 10c. lb.)	575.00
Form lumber, $1.50 per ft. shaft	862.50
Bonus paid	3,075.00
Total cost for 575 ft	$24,812.95
Cost per ft.	$43.14
Cost per cu.yd. of concrete in place (1,231 cu.yd.)	$20.15

SECOND SECTION

Distance concreted, 630 ft., including five stations.
Work started May 1, 1921; finished July 25, 1921—eighty-six days.
Actual time of concreting shaft, after deducting the time lost in cutting new stations, was sixty-nine days, or an average per day of 9.13 ft.

Costs:	
Labor (including supervision at $225 per month)	$5,068.50
Cement used (6,256 sacks at $1.10 per sack)	6,881.60
Sand and gravel (1,434.5 cu.yd. at $2.50 per cu.yd.)	3,586.25
Power used hoisting and crushing (29,310 kw.-hr. at 2c.)	586.20
Reinforcing iron (10 lb. per ft. of shaft at 10c. lb.)	630.00
Form lumber (640 ft. of shaft at $1.50 per ft.)	945.00
Bonus paid	2,056.50
Total cost of completing section	$19,754.05
Cost per ft	$31.35
Cost per cu.yd. of concrete in place (1,174 yd.)	$16.82

"The mixture used was one part cement, two parts sand, five parts crushed rock, or 5⅓ sacks of cement, 10 cu.ft. fines, and 23 cu.ft. crushed rock per cu.yd. of concrete in place."

United Verde's Cottrell Plant

C. R. Kusell, in discussing the research work done by the United Verde Copper Co. at the recent meeting of the Arizona Chapter of the American Mining Congress, described the million-dollar Cottrell precipitation plant that is now being installed. "This plant," said Mr. Kusell, "which is now under construction, is novel in that it includes three different types of Cottrell treaters arranged in parallel. The total capacity will be 800,000 cu.ft. of gases per minute. One-half of this will be handled by down-draft vertical pipes, 12 in. in diameter; one-quarter by the Tooele straight-line horizontal-type utilizing sheets of corrugated iron for the receiving electrodes; and the fourth quarter by a modified Hayden straight-line horizontal type using chain screens for the receiving electrodes.

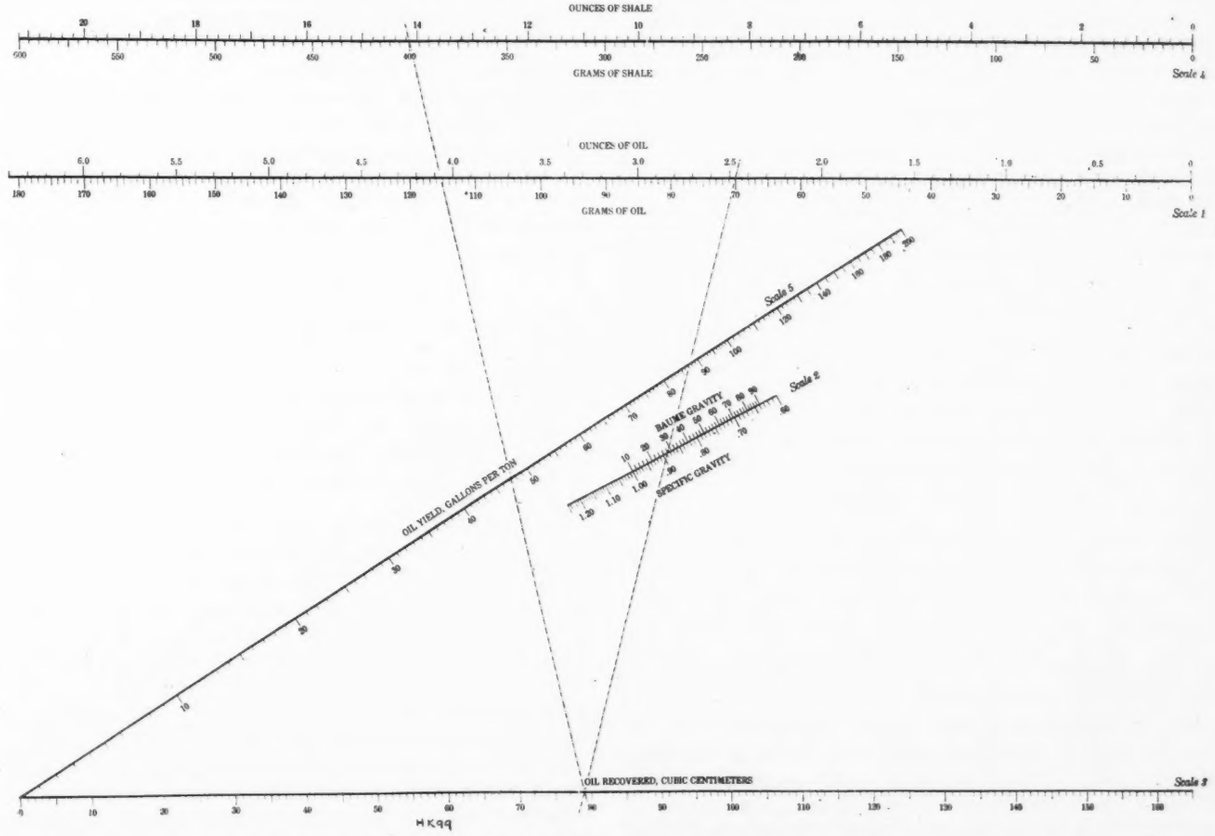
"The straight-line treaters are cheaper to construct, and it has been demonstrated at Tooele and Hayden that they are efficient on easily treatable gases such as roaster gases. It was not known how efficient this type would be on the more difficult gases from the blast furnaces and converters, and as a precaution enough capacity in the pipe type was decided upon. The whole installation is so arranged that the gases may be treated separately or mixed. As the expense of building return flues to the old stack was not much below the cost of a new chimney, the latter was decided upon. It is expected that operation of this will yield much interesting and valuable data besides being a profitable investment.

"Analysis of products precipitated in an experimental Cottrell apparatus revealed that a large portion of the zinc, which is present to the extent of 1 to 3 per cent in the ore smelted, is concentrated in the blast furnace and converter fumes. As a result, research work was started on the possibility of getting the zinc out of the system in the form of some valuable byproduct. After a survey of the market for zinc products, it appeared that lithopone presented the greatest possibilities. Lithopone is made by precipitating a pure solution of zinc sulphate with a solution of barium sulphide, and the resulting white product is zinc sulphide and barium sulphate. It is used principally as a paint pigment and a constituent of mechanical rubber goods, other minor uses being in the manufacture of paper, linoleum, oilcloth, and window-shade cloth. Although it only contains a little over 20 per cent zinc, it has been commanding a higher price than has metallic zinc or spelter.

"Laboratory investigation finally yielded good results in the treatment of the fume from the Cottrell process in the preparation and purification of a zinc sulphate solution and in the subsequent steps to make a good grade of lithopone.

Alignment Chart for Determining Oil Yields in Assaying Oil Shale

Prepared by U. S. Bureau of Mines



To Find Yield of Oil in Gallons Per Ton by Volumetric Method: Join cubic centimeters of oil recovered (Scale 3) with grams of shale used (Scale 4) and read yield on Scale 5.

To Find Yield of Oil in Gallons Per Ton by Gravimetric Method: Join weight of oil recovered (Scale 1) with specific gravity of oil (Scale 2) and read cubic centimeters of oil (Scale 3). Join cubic centimeters of oil determined on Scale 3 with weight of shale used (Scale 4) and read yield of oil on Scale 5.

Note:—Ounces on this diagram are avoirdupois ounces. Tons are short tons of 2,000 lb.

THE PETROLEUM INDUSTRY

The Inorganic Origin of Petroleum

BY HIRAM W. HIXON
Written for *Engineering and Mining Journal*

IN THE ARTICLE[1] by Albert G. Wolf on "Salt Mining in Louisiana," there is an interesting description of the salt domes of the Gulf Coast. The statement is made therein that "The origin of these salt domes is an unsettled question too complicated to go into. The theories of formation vary from evaporation of sea water to the intrusion of salt in a molten or plastic state." I herewith submit a hypothesis not advanced by Mr. Wolf:

The increase of temperature with depth will, at some depth moderate compared to the earth's diameter, result in a critical temperature for all matter. Thereafter all of the interior mass, below a depth of say 200 or 300 miles, will be in a gaseous condition, and denser than the solids that will form out of it. Gravitational compression is the cause of the density, and the conditions of equilibrium make it necessary that the interior mass shall be denser than the crust of solids which rests upon it. All known elements can be volatilized in the electric arc, which is supposed to have a temperature of about 5,000 deg. C. With an increase of 1 deg. C. per 100 ft. of depth, or say 50 deg. C. per mile, the temperature of the electric arc would be equaled at a depth of 100 miles.

EARTH'S INTERIOR A DENSE GAS

A critical temperature for any substance is the temperature above which that substance is in a gaseous condition regardless of pressure. Having passed the critical temperature of all matter, the interior mass of the earth is therefore in a gaseous state, and by the conditions of equilibrium, is shown to be denser than the solid crust which floats upon it. The crust floats on the gaseous interior for exactly the same reason that ice floats on water; that is, because it expanded when it changed from a gas denser than a solid to a solid, due to secular cooling. This expansion on change of state is the active cause which tears apart the cold crust in long rift cracks and furnishes a path of least resistance for volatile material in the interior to reach the surface. As expansion is in three dimensions, it follows that there should be two sets of such cracks at right angles to each other, and at the intersection of these cracks, which have been called lines of orogenic movement, the salt domes are found.

The seal or cap rock is due to some elastic member of the geologic section, probably shale, which will stretch under pressure without fracture. The volatile material, consisting of salt, sulphur, and petroleum, and sulphuric gases, comes up along the cracks as the path of least resistance, and being under a rock pressure equal to the depth from which it comes, is capable of making room for itself and doming up any rock mass which will not crack. The alignment of the salt domes, as shown on the map accompanying the article by Mr. Wolf, is characteristic of all the others, and is explainable on the basis of the rift cracks as above described.

BLOCK FAULTING OF FREQUENT OCCURRENCE

These rift cracks, rift valleys, and graben are much more numerous than generally supposed. For example, there is a series of them in East Africa which is occupied by lakes extending from Lake Nyassa through Lake Tanganyika and the great Rift Valley, the Red Sea and Dead Sea, over five thousand miles in length. In the United States there is the block faulting of the Great Salt Lake Basin, the basin of Death Valley, Yosemite Valley, and Lake Tahoe, as well as the basin of Lake Superior, to mention the best-known examples.

The explanation of these dropped blocks is to be found in the slumping down of segments between cracks, or the dropping of wedge-shaped pieces on the sides of rift cracks. The cracks themselves are caused by the expansion of the sub-crustal material in changing from a geseous state denser than the solid to a solid.

Where there is no cap rock which will stretch without fracture, the crack extends through to the surface, and anything of a gaseous nature which comes up the crack escapes into the atmosphere, and is blown about and dissipated. The cap rock or seal above the crack is an all-important condition for the accumulation of the salt, sulphur, and oil in the salt domes. The process by which the salt, sulphur, and petroleum are accumulated and condensed is expressible in one word: sublimation.

PETROLEUM OF INORGANIC ORIGIN

It is well known that salt and sulphur come from the interior and are a part of the material extruded from volcanoes, but it is not so commonly known that petroleum is also of inorganic origin. Illustrating the differences between petroleum and organic oils, whether animal or vegetable, the following list may be studied to some advantage by those who hold that petroleum is of organic origin:

First: All organic oils, whether animal or vegetable, have both of the elements of water, H and O, as a part of their composition. This makes these oils carbohydrates. The oxygen cannot be driven off unless the oil is destroyed by heat. The familiar process of frying anything once, as practised by some cooks, will illustrate the point. Petroleum, on the other hand, has no oxygen in its composition, and is a mixture of hydrocarbons of the composition expressed by the formula C_nH_{2n+2}.

Second: All organic oils, and organic matter generally, are good fertilizers and promote plant growth. Petroleum kills all plants and is used to kill weeds and grass on roads and railways.

Third: Organic oils, both animal and vegetable, have food values for animals and men. Petroleum has no

[1] *Engineering and Mining Journal*, July 2, 1921.

food value, and the lighter hydrocarbons, such as kerosene and gasolene, are poisonous and are used as insecticides.

Fourth: All organic oils when boiled with caustic soda and potash yield soap and glycerine. Petroleum does not.

Fifth: Organic oils when exposed to sun and air become rancid. Petroleum evaporates, but does not become rancid.

These radical differences of composition and properties show plainly a difference of origin. If petroleum were of organic origin, it would undoubtedly have oxygen in its composition, as oxygen is inextricably connected with all process of organic growth and decay. If petroleum were of organic origin, it would have some of the properties of organic oils, and it has none of them except an oily texture, and another things than oils have that; for example, concentrated sulphuric acid.

To deny the organic origin of petroleum demonstrates nothing; it is essential, to the development of a logical theory concerning its genesis, to prove that it can be of inorganic origin.

Petroleum Hydrocarbons in Meteorites

It was found several years ago that meteorites which were freshly fallen had hydrocarbons of the petroleum type as a part of their composition. Reference to this may be found in Chamberlin and Salisbury's "Geology," in that part which deals with the planetesimal hypothesis. If the earth be conceived to be an aggregation from planetesimals or meteorites, we can at once see why it should have hydrocarbons in its gaseous interior. The hydrocarbons and many other gases would be held there by the power of diffusion, which may have placed them there originally in case the planetesimal hypothesis be not correct. As between the gaseomolten theory or the planetesimal hypothesis there is no difference as regards the presence in the earth's interior of hydrocarbon and all other gases, including steam, for volcanic action.

Applying the theory of the origin of the salt domes and the inorganic origin of petroleum as outlined to the Appalachian oil fields, the following differences arise, due to the *absence* of "sands" in the Gulf Coast section: The salt, petroleum, and sulphur are confined to the domes of their immediate flanks. In the Appalachian oil fields the rift cracks end in "sands," which are porous and allow the oil, gas, and salt water to spread out laterally under large areas covered by an impervious blanket seal of shale, which has stretched under the pressure of the overlying rocks and prevented the cracks from extending further upward.

The oil and gas spread from the rift crack source laterally, and not up the flanks of the anticlines or toward the center of a dome, as supposed by the advocates of the organic theory. The anticlines and domes are also the direct result of elevation by reduction of density due to the local accumulation of leavening gases and light material. In fact, the cart has been placed before the horse, and effect has been mistaken for cause.

The domes and anticlines are not the cause of the accumulation of oil and gas, but the effect of that accumulation over the rift cracks, which are invisible but none the less there.

Petroleum Imports Decreased and Consumption Increased in August

The outstanding facts of petroleum statistics for August, according to the U. S. Geological Survey, compared with those for July, are the decrease in imports of more than 4,500,000 bbl. and the increase in consumption of 1,250,000 bbl., which, despite an increase of production of 636,000 bbl., resulted in a substantial check to the accumulation of stocks of crude oil that has been in progress for many months. The output for August was approximately the same as that for March, and only 1,000,000 bbl. below the record production of May, yet it should be noted that in its total value the August production is far below that of other months, having only about one-third the value of the smaller output of August, 1920. Another significant fact is that the number of productive wells completed during August is the smallest for the year and, indeed, for many months.

Stocks during August increased only 671,000 bbl., whereas since the beginning of the year stocks of crude oil have been increasing at rates between 6,000,000 and 8,000,000 bbl. a month. During August stocks of

PETROLEUM PRODUCED IN THE UNITED STATES IN JULY, 1921, AUGUST, 1921, AND AUGUST, 1920

Barrels of 42 U. S. Gallons

	July, 1921(a)		August, 1921		August, 1920	
	Total	Daily Average	Total	Daily Average	Total	Daily Average
Oklahoma	10,205,000	329,194	10,217,000	329,581	9,371,000	302,290
California (b)	10,247,000	330,548	10,026,000	323,419	8,997,000	290,226
Central and Northern Texas	5,523,000	178,161	5,253,000	169,452	6,148,000	198,323
Coastal Texas	2,557,000	82,484	2,852,000	92,000	2,264,000	73,032
Kansas	3,418,000	110,258	3,337,000	107,645	3,375,000	108,871
Northern Louisiana	2,001,000	64,549	1,842,000	59,419	3,371,000	108,742
Coastal Louisiana	149,000	4,806	133,000	4,290	144,000	4,645
Arkansas	1,400,000	45,162	1,900,000	61,290	.....	.....
Wyoming:						
Salt Creek	669,000	21,681	1,001,000	32,290	951,000	30,677
Big Muddy	157,000	5,064	148,000	4,774	169,000	5,452
Grass Creek	95,000	3,065	99,000	3,194	125,000	4,032
Rock Creek	80,000	2,581	88,000	2,839	102,000	3,290
Elk Basin	49,000	1,580	45,000	1,452	65,000	2,097
Other districts	93,600	3,019	91,000	2,935	112,000	3,613
Total Wyoming	1,143,600	36,890	1,472,000	47,484	1,524,000	49,161
Illinois	805,000	25,968	846,000	27,291	924,000	29,806
Kentucky	706,600	22,794	786,000	25,355	773,700	24,958
West Virginia	727,000	23,452	681,000	21,968	688,000	22,194
Pennsylvania	566,000	18,258	675,000	21,774	640,000	20,645
Central and Eastern Ohio	403,000	13,000	444,000	14,323	469,000	15,129
Northwestern Ohio	173,000	5,580	183,000	5,903	189,000	6,097
Montana	116,000	3,742	119,000	3,839	13,000	419
Southwestern Indiana	77,000	2,484	78,000	2,516	51,000	1,645
Northeastern Indiana	22,000	710	24,000	774	26,000	839
New York	79,000	2,548	86,000	2,774	76,000	2,452
Colorado	8,400	271	9,000	290	10,000	323
Tennessee	1,400	45	1,000	32	1,300	42
Totals	40,328,000	1,300,904	40,964,000	1,321,419	39,055,000	1,259,839

(a) Revised. (b) Average of figures reported by Standard Oil Co. and Independent Oil Producers' Agency.

California petroleum increased 2,173,000 bbl. and net stocks east of California increased 1,611,000 bbl., but stocks of Mexican petroleum held by importers in the United States decreased 3,113,000 bbl. The quantity of these stocks on Aug. 31—168,023,000 bbl.—is more than 52,000,000 bbl. greater than a year ago, an increase of 46 per cent.

Production in California decreased during August as compared with July, 221,000 bbl., which resulted in the state losing first rank to Oklahoma. Decreased production during August is reported also for Kansas, Louisiana, West Virginia, and Tennessee, but increases are reported from other producing states. Arkansas continued its remarkable gain, and in August produced almost as much as Louisiana, it being possible that when complete figures become available the state will have surpassed Louisiana in rank.

The figures in the table on page 623, compiled from company reports to the U. S. Geological Survey, show the quantity of petroleum removed from producing properties.

Prospecting for Oil in Australia

SPECIAL CORRESPONDENCE

The bonus of £50,000 offered by the commonwealth government for the discovery of oil in commercial quantities in Australia has stimulated prospecting for petroleum in several of the states. The efforts in this direction that have attracted most attention lately are those of the South Australian Oil Wells Co., not in South Australia but in Victoria. This company, which is really a Melbourne concern, originally directed its attention to South Australia, but not long ago was reported to be in difficulties with its latest bore there—one sunk at Tantanoola, near Mount Gambier. Now, however, the company has obtained an option over an area at Moutajap, near Hamilton, in Victoria, where a bore put down for water several years ago was said to have disclosed the presence of petroleum. This bore, now down 172 ft., has been inspected by the company's superintendent, H. G. Dod, who has had considerable experience in the Californian oil fields, and he has reported that oil sands proved by the drill have shown the existence of oil and that the indications of oil in the locality are favorable.

Mr. Dod asserts that thick beds of carbonaceous shale contain the organic matter necessary for the formation of supplies of oil, that there are the proper series of strata favorable to the concentration of oil, and that the actual occurrence of petroleum in the shallow bore gives indications of becoming stronger with increasing depth. He writes confidently, and says the possibility of striking payable oil is good. The company has secured leases covering about 500 acres, and intends letting contracts soon for deepening the present bore and putting down others.

In Western Australia, where large areas have been taken up under oil licenses, prospectors have lately sunk a bore 130 ft. on the Fitzgerald River, near Bremer Bay, and claim to have reached oil sands at 28 ft. The discoverer, who has been prospecting the country for oil for eighteen years, speaks glowingly of his prospects, but there has not yet been time for his conclusions to be confirmed by independent evidence. A government geologist is now inspecting the field. Similar indications to those nearer Bremer Bay, which is in the south, have been found in the far north of the state, and geological evidence favors the latter section of the country as against the south.

In Queensland, efforts are still being made to continue drilling at the Roma state bore, in which a broken bit and a part of the stem are jammed about 3,300 ft. down. The driller is doing preparatory work before starting to deflect the bore at 3,000 ft. and if possible drill beyond the obstruction below. He has been occupied at this task for two months or more.

Nothing has been heard for some time of the drilling which was begun last year at Woolston, near Brisbane. This drill was begun on the faith of a "diviner," and the latest report from the locality, published as long ago as last February, was that a depth of 600 ft. had been reached. The diviner was then reported to be "expecting results."

Crude Oil Advances in Price

SPECIAL CORRESPONDENCE

The Texas Co. announced an advance of 25c. per bbl. in the price of North and Central West Texas crude oil on Sept. 28. This advance was met the same day by the other large companies. A second advance of 25c. was made on Oct. 1 by the Sinclair Oil Co., making the price $1.50 per bbl. The price of mid-continent oil, grades Cushing, Yale, Comanche, and Duncan, was also advanced 25c. on Oct. 1 by the Sinclair and Magnolia companies. The advance was met by the Texas Co., and other large companies are expected to follow. During this same week the Standard Oil Co. of Louisiana made two 10c. advances in the price of Eldorado, Ark., crude oil, making the prices 90c. for 34 deg. Bé. and less and $1 for over 34 deg. Bé.

Chile Increasing Consumption of Fuel Oil

Oil is the principal fuel of the Chilean nitrate region, but Iquique is worth consideration as a market for coal, although at present there is no market for the latter, according to a report by Homer Brett, U. S. Consul at Iquique.

Oil has the advantage over coal in this port in that it is handled in the most modern fashion. There are on the shore seven tanks of 33,000 bbl. capacity each, and through pipes running out into the harbor they can pump into bunkers or out of tankers. The railway that serves the nitrate region has many tank cars in use and more under order. Besides these advantages in handling, there is an equally great one in merchandising methods. Oil is brought to Iquique by the producers, kept in stock by them, and sold direct to the ultimate consumer, whereas coal, both at the point of origin and here, is passed along by an almost endless train of agents, brokers, exporters, importers, wholesalers, and retailers. A tank steamer puts out 7,000 tons of oil in a few hours, while a steamer with four hatches does well to discharge 7,000 tons of coal in Iquique in eleven days.

Oil will probably not displace coal for use in the greater part of Chile, but in the nitrate district it has largely done so, and will completely replace it unless better methods of handling and selling coal are put into effect. The freight situation will then be affected, as regular steamers would have to come for nitrate in ballast, and tankers cannot, or at any rate have not, yet carried nitrate as cargo.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Boston Section of A. I. M. E. Opposes Engineers Licensing Bill

The sixty-ninth meeting of the Boston Section of the A. I. M. E. was held at the Engineers Club at Boston, Mass., on Oct. 3, 1921. The meeting was called to order by S. W. Hutchinson.

In the absence of Prof. E. E. Bugbee, Mr. Hutchinson gave an résumé of the report describing the efforts of the joint committee representing the engineering societies of Massachusetts in opposing the Engineers Licensing Bill in that state. Following this report, G. H. Clevenger made a motion, which was seconded by S. J. Jennings, commending Professor Bugbee for his activity and approving his action and that of the committee. After discussion by A. H. Rogers and Mr. Jennings, the motion was passed unanimously, and Professor Bugbee was reappointed as representative for this year.

Mr. Hutchinson reported the plans of the program committee for the next two meetings and then introduced C. W. Goodale, who gave some interesting reminiscences of the formation of the Institute in 1871 and the first meetings.

Mr. Goodale was followed by G. H. Clevenger, who described some lively and interesting meetings at Butte, Denver, Salt Lake, and San Francisco. G. G. Wolkins and S. J. Jennings followed with some observations on the Scranton meeting and the anthracite coal field, the consensus of opinion of all who had attended being that the meeting was admirably managed and most interesting.

The remainder of the meeting included a discussion of anthracite and bituminous coal costs, methods, and production, by F. W. Denton, Mr. Jennings, Mr. Wolkins, and Mr. Rogers.

San Francisco Section A. I. M. E. Meets Director Bain

A large and enthusiastic gathering of the San Francisco Section of the A. I. M. E. greeted H. Foster Bain, director of the U. S. Bureau, of Mines, on the evening of Oct. 4. Marion E. Rhodes, chairman of the House Committee on Mines and Mining, who is accompanying Director Bain, in addressing the section stated that the Committee on Mines and Mining occupied a quasi-judicial position on the proposed bill revising the existing Federal mining laws, and desired mining engineers and operators to communicate with the committee and express their views upon it as far as possible.

Referring to the McFadden bill, Mr. Rhodes said that it is conceded that there are now fewer reasons for the passage of this legislation than there were a year or more ago. He touched briefly on the war minerals relief legislation, pointing out that the claims that would have to be met if the legislation were to be enacted would aggregate a half billion. He stated there was a more widespread demand for tariff legislation than ever before. In his opinion, Congress ought to impose protective duties that would permit many mining enterprises to revive that are now dormant through the inroads of foreign competition. He said: "We are going to do what we can to infuse new life into the mining industry."

Dr. Bain, the next speaker, discussed Institute affairs briefly and then took up revision of the Federal mining laws. In detail he discussed many of the provisions of the proposed laws and showed how they would operate to simplify and clear up existing difficulties and anomalies.

Utah Mine Operators Discuss Problems

The Utah Metal Mine Operators' Institute held meetings at the Commercial Club of Salt Lake City on Oct. 7 and 8, ending with a dinner and dance on Saturday evening at the Hotel Utah. During the Friday morning session the following papers were presented: "Requirements of Hoist Signaling in Metal Mines," by Leonard Wilson, consulting electrical engineer, followed by discussion led by T. P. Billings, O. N. Friendly, and W. H. Cole; "Improved Methods of Stoping Suitable to Utah Mines," by A. S. Winther, general superintendent, Utah Consolidated Mining Co.; "The Mitchell System," by J. B. Hafner, foreman, Titanic Standard mine; "Top Slicing," by A. P. Mayberry, superintendent, Centennial Eureka mine; followed by discussion led by Joseph Hyland, R. E. Phelan, and J. A. Norden.

The Friday afternoon session included the following papers: "The Field for Storage Battery Locomotives in Utah Mines," by E. A. Hamilton, superintendent U. S. Mines, Bingham, followed by discussion led by L. R. Dobbs and H. T. Plumb; "Efforts of the American Mining Congress in Standardizing Mining Machinery and Methods," by H. C. Goodrich, chief engineer, Utah Copper Co., followed by discussion led by Charles Zabriskie and E. H. Burdick.

The Saturday meeting covered the following papers and discussions: "Experience in Overcoming Hot Mines Gases, Including Guniting Drifts," by A. J. May, superintendent, Tintic Standard mine, followed by discussion led by Lew Merriman and A. C. Nebeker; "The Present Status of the Wet Stoping Drill," by H. G. Snyder, metal-mine inspector, followed by discussion led by William Owens and H. N. Hartman; and "Should Metal Mine Operators of Utah Conduct Future Meetings of this Kind," by L. S. Cates, manager, Utah Copper Co., the discussion being given by E. F. Birch, A. G. Makenzie, D. D. Muir, and J. F. Johnson.

Natomas Co. Entertains California Dredge Operators

Gold-dredge superintendents of California held their monthly meeting at Natoma and vicinity on Sept. 27. They were the guests of the Natomas Company of California. L. D. Hopfield, in charge of the gold-dredging operations at Natoma, planned an interesting day's entertainment, which began at the Fair Oaks rock-crushing plant. At this plant the waste rock resulting from dredging operations is washed and part of it crushed. Washed gravel and crushed rock in several sizes are shipped to many points in the state for road building and construction purposes.

After luncheon Natoma No. 8 was visited. Natoma 9, which recently sunk, was next inspected. The dredge pond has been unwatered and the dredge is being dismantled. The hull rests on its side, making an unusual and spectacular sight. Natoma No. 7, to which the guests were taken also, is being dismantled preparatory to moving it to another area. After supper at Natoma, the regular meeting was held at the club house of the company. Charles W. Gardner presented a paper, "Drilling Results and Dredging Returns," a continuation of the discussion introduced by G. H. Hutton at the Nevada meeting of dredge operators.

R. G. Smith, engineer assistant to L. D. Hopfield, made the most extended reply to Mr. Gardner, and showed that the recovery of the dredge was an important factor in explaining discrepancies between the results obtained in the examination and the recoveries made in operation.

Pennsylvania State College Plan of Industrial Training

For ten years a staff of highly trained men in industrial education has been maintained at the Pennsylvania State College, and large sums of money have been spent in studying methods of conducting apprentice schools and night classes in the industries. This staff, known as the Engineering Extension Division of the college, has personally organized and operated hundreds of classes in some of the best-known plants in Pennsylvania, among them being manufacturers of iron and steel, electrical equipment, machines and tools, automobile parts, textiles, and of other products common to the state. Each such enterprise was accompanied by an intensive study as to the character-

istics which entered into its success or failure.

According to the Extension staff, the chief reasons for the poor results obtained in most industrial classes are the differences in previous education and experience on the part of the students, their varying capacity for study, the use of the wrong kind of lesson material, and the fact that too often they have to study what is offered rather than what they want.

These objections, together with many others, have been completely removed by the new State College plan, which is, in effect, a combination of class and correspondence study. There the student studies anything he wants, regardless of the fact that no others may be taking the same subject. He may select anything along the lines of shop mathematics, drawing, electricity, power-plant subjects, mechanics, strength of materials, or design, and his lesson material will be elementary or advanced, according to the amount of his previous education and experience.

Bureau of Mines Submits Standard for Permissible Explosives

Standard specifications for the testing and use of permissible explosives for use in mines, "Bureau of Mines Schedule 17," are now before the American Engineering Standards Committee for consideration and approval as tentative American standards. These standards are the result of thirteen years' experience by the Bureau of Mines in testing and in assisting manufacturers to develop explosives which offer the minimum hazard, when properly used, in gaseous and dusty mines.

Standard methods of testing explosives were first published by the U. S. Geological Survey as "Explosives Circular No. 1" on May 15, 1909, together with the first list of seventeen permissible explosives. By 1915 data on the testing of upward of 200 explosives had been accumulated, and 134 explosives had been placed on the permissible list. In June, 1915, the Bureau of Mines called a conference of representatives of manufacturers of explosives to discuss the methods of testing employed and to determine the tolerances to be permitted in the retesting of field or of manufacturers' samples. As a result of this conference, a series of tolerances was issued on July 1, 1915.

In November, 1920, the Bureau of Mines reviewed the rules and regulations then governing the testing and placing of explosives on the permissible list. In this review the committee took into consideration the data accumulated in the testing of 290 different explosive materials, of which 195 had been classed as permissible. The revised rules formulated as a result of this study were submitted to the explosives manufacturers of the country for their comment and criticism. With these comments in hand a final revision was made and approved as "Schedule 17" on April 8, 1921.

The committee would be glad to learn from those interested of the extent to which they make use of these specifications, and to receive any other information regarding the specifications in meeting the needs of the industry.

MEN YOU SHOULD KNOW ABOUT

David White was in Nashville on Oct. 7 to confer with state geologists.

D. F. Hewett is doing field work for the U. S. Geological Survey near Good Springs, Nev.

Morton Webber has returned from Mexico to New York, and left for Canada on professional business.

S. Paul Lindau has accepted the position of engineer for the western branch of the United States Gypsum Co.

Dr. Gustaf Alling, a mining engineer of Stockholm, Sweden, is in the United States to make a study of hygienic conditions in mines.

P. A. Anderson, mining engineer, and **Folke Westerberg,** civil engineer, both of Kiruna, Sweden, are visiting the Michigan iron ranges.

M. C. Lake, of Wilkes-Barre, Pa., geologist for M. A. Hanna & Co., inspected the company's properties at Crystal Falls, Mich., recently.

George H. Garrey, consulting geologist for the Tonopah Belmont Development Co., arrived in Tonopah on Sept. 28 from his Philadelphia headquarters.

A. J. Collier, of the U. S. Geological survey, has returned to Washington after having been engaged in classifying mineral land on the Fort Belknap Indian Reservation.

Alfred H. Brooks, head of the division of Alaskan Mineral resources of the U. S. Geological Survey, returned to Washington on Oct. 10, after having spent the season in Alaska.

Howard R. Ward, of New York, will be in the West during October and November, making examinations of mining properties in Arizona, Baja California, and northern California.

Prof. A. E. Seaman, who has been conducting geological work in the Crystal Falls (Mich.) district for the McKinney Steel Co., has taken up his duties at the Michigan College of Mines.

H. Foster Bain, director of the U. S. Bureau of Mines, has found it necessary to curtail the latter part of his Western trip, and is expected to return to Washington by the middle of the month.

Martin Schwerin, manager of the Spar Mountain Mining Co. for the past three years, will resume the practice of consulting mining engineer on Jan. 1, with offices at 42 Broadway, New York City.

Alvin E. Richards, formerly superintendent of the Tobin Mine of McKinney Steel Co., is now superintending operations at the Imperial mine, Michigamme, Mich., for the Henry Ford interests.

Arthur L. Walker, professor of metallurgy, will attend the convention of the American Mining Congress to be held at Chicago, Oct. 17, as representative of the engineering schools of Columbia University.

C. V. Corless, general manager of the Moud Nickel Co.'s operations in Canada, has returned from a consultation with the head office in England. He states that there will be no further curtailment of mining and smelting work.

George S. Rice, chief mining engineer of the U. S. Bureau of Mines, assisted personally last week in some of the final tests of the effect of automobile exhaust gases in a tunnel which were made at the experimental mine at Pittsburgh.

Bernard MacDonald, previously in charge of the mining and milling operations of the Veta Grande unit of the American Smelters Securities Co., in the Parral district, has opened an office in the city of Parral and will take up private professional work.

George L. Heath, formerly chief chemist for the Calumet & Hecla Mining Co., has joined the faculty of the Michigan College of Mines at Houghton. Other new members of the faculty are **R. R. Seeber,** formerly manager of the Winona mine, but more recently in Nova Scotia, and **W. C. Polkinghorne,** who was superintendent of the Ahmeek stamp mill at the time of its suspension last April. Messrs. Seeber and Polkinghorne are graduates of the college.

Mining and metallurgical engineers visiting New York City last week included: **C. L. Colburn,** Pittsburgh, Pa.; **George A. Packard,** of Boston, Mass.; **A. L. Flagg,** of Phoenix, Ariz.; **H. W. Edmonson,** of Eden, Vt.; **Warren D. Thompson,** of Boston, Mass., and **A. L. Lewis,** of Chile.

SOCIETY MEETINGS ANNOUNCED

The annual meeting of the **Society of Economic Geologists** will be held, in conjunction with the annual meeting of the **Geological Society of America,** at Amherst College, Amherst, Mass., Dec. 28-30, 1921.

OBITUARY

Charles W. Whitley, vice-president of the American Smelting & Refining Co., died on Oct. 9 of pneumonia, at the age of fifty. Mr. Whitley had extensive business interests throughout the West and represented the A. S. & R. Co. in Salt Lake City until three years ago, when he came to New York to assume the vice-presidency of the company.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Leading Events

Recent experiments of the Anaconda Copper Mining Co. in the manufacture of a rust-proof copper shingle have attracted some attention, as being part of a movement to create new uses for copper. The slogan "Buy Something Made of Copper" is also being widely used in the Southwest.

The United Verde Extension Mining Co. has acquired coal mining rights on 200 acres of land at Gallup, N. M., thus insuring a supply of fuel for its powdered-coal-fired reverberatories. Plaintiffs in a smoke damage suit against the company have been awarded nominal damages.

A departure from its usual metallurgical practice is to be made by the Springs Mines, in South Africa, which company intends to abandon stamp milling and amalgamation in extending its treatment plant and adopt an all-sliming and direct cyaniding process.

The McFadden gold bonus bill stands little chance of passing, if Secretary Mellon, of the Treasury, has anything to say about it. His reply to the Western Senators, recent request will be given out soon.

A conference on the exchange situation is proposed in a bill, hearings on which have been started by the House Committee on Banking and Currency.

Iron-making conditions in the Birmingham district of Alabama are showing a slight improvement and the future is brighter. The situation in the Lake Superior district is still very dull, though various companies are hastening to ship their stockpiles before cold weather sets in.

"Buy Something Made of Copper" Slogan in Southwest

Calumet & Arizona Offering $50 for Best Suggestion—New Cornelia Making Copper Road Signs and Other Articles

The slogan "Buy something made of copper" has spread all over the Southwest. Leading in the movement is the Calumet & Arizona Mining Co., which is offering a $50 prize for the best suggestion received for utilization of copper. The New Cornelia, a C. & A. subsidiary, is "casting" articles, such as automobile radiators, road signs of several sorts, and kitchen utensils, all perfected in the sulphuric acid tanks at Ajo. One practical use for copper sheets is in roofing a new home in Jerome for Lewis Douglas. The owner wants the copper to turn green, but it oxidizes brown in the dry Arizona air. So he is having the roof painted with acids to bring out the desired hue.

U. V. Extension Gets Coal Mining Rights at Gallup, N. M.

Announcement has been made by George Kingdon, general manager of the United Verde Extension Mining Co., that he has secured for his company coal-mining rights on 200 acres of land at Gallup, N. M. The purchase was from the Mutual Coal, Light and Power Co., which has retained surface rights to forty acres within the Gallup townsite, this tract to be divided into town lots. With the coal land is included a right of way for a railroad to the main line of the Santa Fe railroad from the property's coal tipple. The purchase is of much importance, in that it assures a fuel supply for the Extension's reverberatory furnaces, which are operated with powdered coal, instead of oil. Until copper production is resumed at Clemenceau, the Gallup coal property will be operated, under lease, by H. R. Wypur and associates.

Anaconda Makes a Copper Shingle Experimentally

Copper-Zinc Alloy Used Said To Be Rust-Proof—Question of Cost Remains To Be Solved

Production of a metallic shingle at the Washoe Reduction Works of the Anaconda Copper Mining Co. created some interest recently in metallurgical circles in Butte, this experiment appearing to promise much in the way of the development of a new enterprise for the Anaconda company, and, incidentally, further emphasizes the attention this copper producer is giving to the matter of a diversification of its activities. These shingles are made of an alloy of copper and zinc and are said to be impervious to rust. They are 10 by 24 in. in size, are thin, tough and give a neat appearance to a roof, a small building at the smelter having been covered with them. It is believed that the color can be varied. All that remains is to bring the cost of manufacturing down to that point where they can be placed upon the market in successful competition with the wooden article, and it is believed that this can be done.

Attention is also being given to the manufacture of a shingle nail made up of the same alloy, and the metallurgists believe they have a product which will be heard from later. The experiments of the Anaconda are in line with the program of the copper-producing companies to promote new uses to which copper may be applied in order to create new markets.

Outlook at Birmingham Reported To Be Better

Ten Furnaces Expected To Be in Blast Oct. 16—Rumored That Various Ore and Coal Mines Will Resume

The October schedule for Birmingham district iron makers would seem to clearly indicate that the bottom for pig-iron making in Alabama has finally been reached and that an upward trend of affairs toward normal may now reasonably be taken as an established fact. Heretofore, under similarly depressed and dull market conditions, there would have ordinarily been eight to ten stacks in blast, with about 350,000 to 400,000 tons of iron in the furnace or the warrant yards, and with stocks still accumulating, whereas early in 1921, under recent unparalleled conditions, financially and otherwise, furnaces continued to go out of blast until only two stacks remained active out of a possible total of forty coke furnaces, and an average total of about twenty-seven.

In the Birmingham district today, taken as a whole, a sale basis of $20 per ton leaves less than $6 per ton to cover conversion cost, all supplies, repairs, and overhead, with profit eliminated. It is a fair assumption that the same cost balance may have been struck in many Northern furnaces, when a sale price of $25 per ton at the furnace was reached.

The sooner more consumers become convinced of these facts, the better it will be for themselves and for the industrial situation generally, assuming that, as is announced with some degree of authority, increasing business is now in sight for iron fabrication at fairly remunerative prices.

Three new furnaces are to be put in blast, making ten in all which should be in active operation by Oct. 16.

No. 2 stack of the Woodward Iron Co., which has recently been under repair, will be fired at once, making the full bank of three furnaces at Woodward in blast.

The Republic Iron & Steel Co. should have its No. 1 Thomas furnace, a 300-ton stack, in blast by this time.

A third new addition to October iron making will be the No. 1 furnace of the Alabama Company at Gadsden.

No announcement of increased iron production in the immediate future has as yet been made by the Tennessee Coal, Iron & R.R. Co., four of whose Ensley furnaces are now running on basic iron.

Three of the six open-hearth furnaces of the Gulf States Steel Co., idle since early this year, were again lighted on Sept. 30, all departments now being active except the iron furnace, which is not likely to resume before late in the year.

Should conditions warrant, there are still eight furnaces in the Birmingham district which could be blown in at twenty-four hours' notice, five within a week, and six more in from sixty to ninety days.

In view of the more active iron-making program, considerable attention has been and is being given to resumption by ore and coal mines.

All the ore at present mined by the Tennessee Coal, Iron & R.R. Co., on Red Mountain, is going to its four furnaces in blast at Ensley, two of its Muskoda mines having recently resumed operations.

Muskoda No. 6, which is the largest ore mine of the Tennessee company on Red Mountain, working the largest number of men, is again operating three days per week, and will for the present continue to be so operated. Muskoda No. 4, the starting up of which was announced, has been delayed by shaft repairs.

It is rumored that Raimund Mines will resume operations on or about Oct. 15, but no official announcement has yet been made to that effect.

The fact that repair and a general clean-up program has been in progress at the Sloss mines is assumed to indicate that their opening up is imminent, although the Sloss Sheffield Steel Iron Co. has as yet no furnaces again in blast and has made no official announcement of activity either in mining or in iron making.

The ore mines of the Woodward Iron Co. will soon be approaching normal output, with the full complement of stacks at Woodward in blast.

Some entirely new developments in Alabama iron making may be foreshadowed by the filing on Sept. 24 of two mortgages in DeKalb County, one given by the White Coal & Iron Co., for $1,500,000, the other, issued by the Palatine Mining & Development Co., for the same amount, both mortgages being in favor of the Chicago Title & Trust Co., of Chicago, covering mineral lands recently acquired, both coal and iron, in DeKalb and Marshall counties, Alabama. It is understood that the property so acquired is the original holdings of the Fort Payne Coal & Iron Co., succeeded by the Fort Payne Co. about thirty years ago, after its failure. Should the announced program of the present owner of these properties be carried out, some developments of interest may be looked for in and around Fort Payne at an early date.

Hecla Injunction Suit Out of Court's Jurisdiction

Plaintiffs Announce Intention of Applying to Idaho Court — Will Bring Bunker Hill & Sullivan into Case

Judge Huneke, of the Superior Court of Spokane County, Wash., decided on Oct. 5 that his court had no jurisdiction in the suit brought by Eugene R. Ray and Sarah E. Smith, minority stockholders of the Hecla Mining Co., who sought to restrain the directors of the company from proceeding with the contract for purchase of an half interest in the Star mine. The court sustained a motion made by the defense for dismissal. The temporary restraining order was held in effect for five days pending the security of an injunction by the plaintiffs in Idaho courts and to permit the plaintiffs to bring the Bunker Hill & Sullivan company into the case. The order was based on the fact that the Bunker Hill company had an interest in the suit and being an Oregon corporation was beyond the jurisdiction of the Washington courts. The plaintiffs announced their intention of applying immediately for an injunction from Idaho courts.

North Broken Hill Report Shows Net Loss for Year

By Cable From Reuters to "Engineering and Mining Journal"

London, Oct. 10—Despatches received today from Melbourne, Australia, report that the operations of North Broken Hill, Ltd., show a net loss of £62,242 for the past year.

Rio Tinto Passes Dividend

By Cable From Reuters to "Engineering and Mining Journal"

The Rio Tinto Co., Ltd., failed to declare an interim dividend on its ordinary shares. The half yearly dividend on the preference shares was, however, maintained.

Taxes Increase 30 Per Cent at Ironwood, Mich.

The total tax rate in the city of Ironwood will this year amount to about $5.20 per $100, which is an increase of nearly 30 per cent over last year's rate. The mining companies pay about 80 per cent of the taxes in the city, and they are in consequence greatly affected by this increase. The state tax was decreased considerably, but the city's tax was increased much more.

Mining Conditions Improving In British Columbia

Gold Production May Drop in 1921, But Outlook Is Brighter—Silver Situation Better

BY ROBERT DUNN

Victoria—Activity both in placer and lode gold mining is becoming more marked in British Columbia. As to the former, however, it is too late in the season to expect that the revival will have much, if any, effect on the year's output. A general survey of the placer and lode mining situation points to a decline in the total value of the year's work in comparison with the output of the previous year.

The Nickel Plate mine was the big producer in the past. Its output was much less than usual in 1920, and the mine was closed down entirely in the fall. In 1921 it has been doing nothing. The Rossland mines, another important source of gold heretofore, have been operating in desultory fashion. The Britannia Mining & Smelting Co., on Howe Sound, the gold production of which is usually not inconsiderable, has been idle for months, the only work being that of development.

On the other hand, the Nickel Plate has again opened up, and there are clear signs of bigger operations at Rossland; the Britannia will be a substantial shipper again as soon as the mill now being built to replace the one burned down is completed. A few months will accomplish this work. The Belmont-Surf Inlet mine on Princess Royal Island, which last year produced more than 44,000 oz. of gold, 20,000 oz. silver and more than 500,000 lb. of copper, has been doing work involving, among other things, the construction of a tramway to connect the Pugsley mine with the Belmont mill. With this finished the output will be materially increased. The Hidden Creek mines and the smelter of the Granby Consolidated Mining & Smelting Co., have been working steadily, and some gold has been produced. Probably about the same quantity will be shown for 1921 as in 1920.

The output in 1921 of the Premier Mining Co., on Salmon River, can only be estimated. Last year 800 tons of ore was shipped, carrying 2,283 oz. gold and 77,352 oz. silver. Doubtless this, because of the expensive transportation, was selected ore. With these charges reduced, and especially with the aërial tramway completed, more ore, probably of a lower average grade, will be shipped. Everything considered, it is probable that the gold output of the Premier will show a considerable increase.

In addition to these, the Dolly Varden, near Alice Arm, produced, when shipping, considerable lode gold, and there are prospects both in the Portland Canal and the Alice Arm sections, and elsewhere which have promise. Among these are the Emancipation, near Hope, where a new mill is being installed; the Nugget, at Sheep Creek, where the orebody has been proved;

the Pioneer and the Lorne mines, in the Bridge River district; and the newly discovered gold area of the Whitewater region, in the Lillooet district, to which a rush of prospectors is expected next season.

As to placer mining, it is stated by one of the prominent operators of the Cariboo that the production there will be about the same in 1921 as it was in 1920, when it was 3,300 oz., which came from the officially designated divisions of Cariboo and Quesnel. It is thought that the output from the Cassiar will show a slight decline in 1921. The 1920 production in the Cassiar division, covering the Atlin, Stikine, and Liard districts, was 6,930 oz.

However, there is a marked quickening of interest in placer mining. Dredging and hydraulicking leases are in demand. Individual claims are being staked and worked more extensively than for years. This applies not only to the established camps of the Cariboo and the Cassiar, but as well to the less generally known fields of the Kootenays. The Wild Horse Creek Placer Gold Mining Co., on Perry Creek, is about to close the season's operations and is looking forward to a satisfactory clean-up. Other hydraulicking operations have been under way on this creek during the season, with good result. The Roses Gulch Placer Gold, Ltd., organized at Vancouver, has four claims at Quesnel for the exploitation of which capital is being raised.

Summing up, there may be a decline in the gold production of British Columbia for 1921, but given a continuance of the present trend toward more normal conditions, the industry should show a notable improvement next year.

Regarding silver production it may be noted that the market has been down and that the independent operators of the chief silver districts of British Columbia, namely, the Slocan and other sections of the Kootenays, have been doing very little. Now, however, conditions are changing. Early in October silver was back to 71½c. per oz. This, together with the announcement of the Consolidated Mining & Smelting Co. that a change will be made in the schedule of treatment charges and that hereafter cash will be paid for ore, has had an inspiring effect on the mining industry throughout the interior. Mines that either have been shut down or working on development alone are being put in condition for shipment, and there is not the slightest doubt that the output will be materially increased in the immediate future. Apparently the effect of the new buoyancy is not confined to the Kootenays, as it is reported on good authority that the Taylor Mining Co. is to proceed with further development of the Dolly Varden mine, at Alice Arm, which has been practically closed down for some months. It is said that 4,000 tons of ore will be shipped in November. On the Wolf group adjoining, belonging to the same company, a compressor plant is being installed, and 500 ft. of tunnel work will be done during the winter. The hydro-electric plant placed on the Wolf last summer will supply the power needed at the Dolly Varden and in the development of the Wolf.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Mellon Against Gold Bonus

Secretary of Treasury Does Not Favor McFadden Bill — Reply to Senator Oddie To Be Made Public Soon

The Secretary of the Treasury does not favor the payment of a bonus to stimulate gold production. This is set forth clearly in his reply to Senator Oddie, of Nevada, who transmitted to him the recent resolution signed by twenty-two Western Senators in which arguments were presented for the need of increasing gold production.

The text of the reply of Secretary Mellon has not been given out as yet, but it is understood that his attitude is practically the same as that of the Treasury Department during the preceding administration. Senator Oddie expects soon to give out Secretary Mellon's letter, accompanied by a statement pointing out some of the exceptions that he takes to the Secretary's premises and conclusions.

Over Half of Rail Tonnage Mine Products

During the quarter ended June 30, 1921, the Class 1 railroads of the country carried as revenue freight 124,345,374 tons classified as products of mines. The division of the tonnage is as follows: Anthracite coal, 21,254,080; bituminous coal, 65,908,865; coke, 1,563,567; iron ore, 8,767,062; other ores and concentrates, 887,343; base bullion and matte, 93,416; clay, gravel, sand and stone, 22,843,027; crude petroleum, 1,159,380; asphaltum, 328,825; salt, 627,908; and other products of mines, 711,901. The total tonnage hauled during the second quarter of all commodities was 222,575,624 tons. Thus the products of mines represented more than one-half of the grand total.

The tonnage of the other groups is as follows : Products of agriculture, 21,385,267; animlas and products, 5,775,453 tons; products of forests, 19,746,413 tons; manufacturers and miscellaneous, 41,894,693 tons.

Conference on Foreign Exchange Proposed

House Banking Committee Starts Hearing on Bill Authorizing Meeting

Hearings were begun Oct. 8 before the Banking and Currency Committee of the House of Representatives on the bill which would authorize the President to invite Great Britain and France to send three representatives each to Washington to meet three representatives of the United States in a conference on the exchange problem. Representative McFadden, the chairman of the committee, attributed the slowness of financial recovery to the uncertainties of exchange. H. N. Lawrie, the economist of the American Mining Congress, appeared before the committee and urged the passage of the bill. He said the mining industry is particularly dependent on export trade if full-time operation is to be maintained.

Production of Copper in Alaska Likely To Increase

Large Producers Have Long Life in Prospect, in George S. Rice's Opinion —Extensive Mineralized Areas Exist

Every indication points to a progressive increase of copper production in Alaska, according to George S. Rice, chief mining engineer of the U. S. Bureau of Mines, who recently returned from an extended trip through that territory. Mr. Rice bases his belief on the fact that the large producers possess indisputable evidence of being long-lived properties, and there is no reason to suppose that the mines working on lens-like deposits will not continue to find similar bodies.

Extensive copper mineralization is known to exist in many districts other than the areas from which present production is coming. Gold miners of many regions complain of the trouble they have with copper nuggets. Their operations are too far from transportation to enable them to handle this heavy and comparatively low-valued product. It is Mr. Rice's belief that new copper lodes will be brought in from time to time, and that doubtless some of these will be of sufficient richness to justify railroad branches. Nothing less than rail transportation will permit of any extensive development of these deposits. At the time of Mr. Rice's visit the copper output of Alaska was practically normal.

NEWS BY MINING DISTRICTS

London Letter

Arizona Copper Co. Shareholders Disappointed at Terms—Springs Mines To Try All-Sliming and Direct Cyanide Treatment in New Unit

BY W. A. DOMAN

London, Sept. 30.—Not for a long time have we had such a sensation as that connected with the Arizona Copper Co. As is well known in the United States, the directors have been in negotiation with an American corporation for the sale of the whole undertaking. The name of the corporation was kept secret; it now appears from an official announcement to be the Phelps Dodge. Silence was preserved as regards terms, and only rumors or suggestions got on to the market. (The story is given on p. 586 of *Engineering and Mining Journal* of Oct. 8, 1921, and on p. 639 of the Oct. 15 issue.)

Shareholders of the Arizona company are naturally disappointed at the terms, and have endeavored to sell. This has caused a fall in the price from about about 35/— to 18/—for the 5/— shares. Holders are also angry at the brief period given them in which to consider the terms. They state that no effective opposition can be organized, and a clause in the purchase agreement is that the offer must be accepted by Oct. 3. The Scottish banks are reported to have lent money on large blocks of Arizonas, which means that unless the price rallies the loans will be called in.

A bold departure from recognized Rand metallurgical practice is being made by Springs Mines. As a result of experiments the directors have decided to abandon stamp milling and amalgamation, when extending the treatment plant, in favor of "all-sliming" and direct cyanide treatment. They claim that the change will result in reduced capital expenditure, a probable saving in operating costs, and increased extraction of gold contents. Evidently the views of G. A. and H. S. Denny, held and advocated for so many years, on the advantages to be derived from the all-sliming process, have made great impression upon C. R. Davis, the consulting engineer of Springs Mines, and as a result of experiments the directors of the company have come to the conclusion above stated. It will be noticed that the directors make only one definite claim—that capital expenditure will not be so heavy; the other advantages expected come under the head of probabilities. Lower capital expenditure and operating costs will be welcome.

The directors of Mason & Barry announce that negotiations are being carried on which may lead them to recommend the sale of the company's property in Portugal.

Johannesburg Letter

Accident at Consolidated Langlaagte—Stabilizing Price of Gold Recently Discussed

BY JOHN WATSON

Johannesburg—At the Consolidated Langlaagte mine on Aug. 23, as a number of natives were ascending the ladder-way, which is about 35 ft. long and set at an angle of about 38 deg., a wooden box-launder connected with a sump burst. The result was that slimy water, silt and timber slipped down the ladder-way, causing a panic among the natives. Four natives were fatally injured and about twenty more were slightly injured.

The question of stabilizing the price of gold has been to the fore, here, recently. The *Rand Daily Mail* of Aug. 26 reported a statement by D. C. Greig, who was chairman of the Johannesburg Stock Exchange, to the effect that arrangements were likely to be concluded for the sale forward of gold produced in South Africa for a considerable period, say two years. There has been during the week a considerable rise in the selling price of leading gold stocks. However, the *Star* on the same day said that on making inquiries it had learned that a period as long as two years would involve many serious risks. A great many factors enter into the question of production and mines might be unable to supply that which they had contracted to deliver. Gold cannot be dealt in by the same methods as other commodities. It is sold by transactions in the international exchange market, and these operations are among the most risky and speculative that can be indulged in. The trend of gold prices is hard to determine and the workings of international exchange still more difficult to foresee. In the *South African Mining and Engineering Journal* of Aug. 27 an instructive diagram or graph shows the fluctuations in the gold premium from January to July of this year. It also shows that, when the price of gold falls to 99/ per fine ounce, sixteen gold mines now working in the Transvaal will be working at a loss and 5,800 European employees will be affected. When the price falls to 89/ the number of mines working at a loss will have increased to twenty-six and the number of Europeans affected will number 12,000. At 84/ per fine ounce, thirty-one gold mines will no longer pay and 14,400 white employees would be affected. The reduction in wages, recently made by mutual agreement, will help to a small extent.

KOREA

Unsankinko—The September cleanup of the Oriental Consolidated Mining Co. was $83,775.

CANADA

British Columbia

"Black Lead" at Franklin Camp Yields Platinum

Usk — On the Peerless group, Kleanza Creek, tunnels and stripping have revealed ore in the form of bornite, chalcocite, magnetite and manganese oxides. An adit was started to get under the largest body of ore, but was not completed. A camp is being constructed on the Silver Horde, at the head of Chiminess and Kleanza Creeks, where there are bodies of ore in which gray copper predominates and which contain high silver values. The provincial government is doing some road construction in this district that will materially aid in development.

Grand Forks — Interesting developments are reported at Franklin Camp. It is stated that on the "Black Lead" of this section there has opened up about 10 ft. of 4.3 per cent copper carrying 0.11 oz. in platinum. This so-called "Black Lead" is a pyroxenite formation extending about two miles in length and averaging about 1,000 ft. in width. It has long been maintained that it is the source of the platinum found in the placers of the Tulameen River.

Princeton — Repairs and improvements are being made on the Kettle Valley railroad to Copper Mountain.

Salmo — The Nugget Gold Mines, operating the Nugget and Mother Lode properties, has been earning a small profit each month of operation this season, and with a further reduction of mining and milling costs the outlook for a substantial increase is regarded as promising.

Trail—Ore shipments received at the Consolidated smelter during the week ended Sept. 31 totaled 7,983 tons from the following shippers:

Mine	Location	Wet Tons
Bell	Beaverdell, B.C.,	27
Josie,	Rossland, B.C.,	125
Knob Hill,	Republic, Wash.,	95
Paradise,	L. Windermere, B.C.	45
Ruth,	Cedar Creek, B.C.	41
Sally,	Beaverdell, B.C.	18
Freddy Lee,	Ainsworth, B. C.	2
Skyline,	Ainsworth, B.C.	1
Company Mines,		7,629

Ontario

Construction of Addition to McIntyre Mill Now Likely—Teck Hughes May Take Over Orr Property

Cobalt—It is understood that though the Vipont mines, in Utah, owned by the Kerr Lake, made a profit last year, no money was received from it by the Kerr Lake Mines, Ltd., the holding company. The Kerr Lake Mining Co., of

Cobalt, made profits of only $29,000 for the fiscal year, so that the dividends paid were from surplus, the Cobalt company transferring $590,000 to the holding company.

For the week ended Sept. 30, the shipments from Cobalt consisted of two cars, one from the Hudson Bay of 31.8 tons and a car of La Rose ore shipped by the Temiskaming Testing Laboratories.

Official announcement is made of the proposed sale of the properties of eighteen Cobalt companies for arrears of taxes, which, in practically every case, are less than $100. The names of these companies are remiscent of the early boom days in Cobalt, during which period they were formed.

The plant of the Trethewey property in Gowganda has been put in condition for work. It was burned down last spring, and no work has been done since. The company is short of funds and will have to be reorganized before work can be started.

Kirkland Lake—There is reason to believe that the Orr property will be taken over by the Teck Hughes when the reorganization plan of the latter company, with respect to its outstanding bond issue of $600,000, is completed.

The Sylvanite will soon begin the sinking of a new three-compartment shaft some distance west of the old shaft. The new power house is about completed, and repairs are being made to the plant. The old shaft was too small for the scale of work proposed.

Negotiations are under way for the purchase of the Townsite property by English interests. The property adjoins the Lake Shore and Wright Hargraves, and although the surface showings are comparatively unimportant, it is believed that deep development will be productive.

In November the Wright Hargraves mine will start sinking from the 400 to the 800 level. To handle the additional work, a new eight-drill compressor is being installed. The mill is treating 160 tons of $15 ore a day.

Development work on the 400 and 600 levels of the No. 2 vein of the Lake Shore has been so satisfactory that the company is considering the erection of a mill of larger capacity.

The Kirkland Lake Gold is now developing good ore on the 900 level. Mill heads are running $9 a ton.

Porcupine — Recent rains of almost tropical violence have apparently solved, for the present season at least, the power troubles in Porcupine, which were much more critical than the general public believed. It will not, however, solve the problems of the future, and if the camp is to expand as is anticipated, more power will have to be developed. Even now, with the question settled for the winter, only the three big mines, the Hollinger, the Dome, and the McIntyre, can get power, and if any of the other properties in the camp desired to start, they would not be able to contract for a supply.

The Hollinger is apparently serious in its intention to increase its milling capacity to 5,000 tons a day, which can be done with only minor changes. The preliminary crushing will be followed by rolls, and ball mills will be used in place of stamps. Additional ore-hoisting facilities are available in the main shaft. When this is done, all ore above a grade of $4 a ton will be included in the ore reserves, and this will bring the positive reserves up to $53,000,000. Milling 5,000 tons a day the company will require at least 10,000 hp.

The addition to the McIntyre milling equipment of a new 500-ton unit has been delayed only on account of the uncertainty of power, but it is probable that it will now be erected. Within the last few weeks the company has been considering the installation of a steam power unit, but this plan will probably be abandoned.

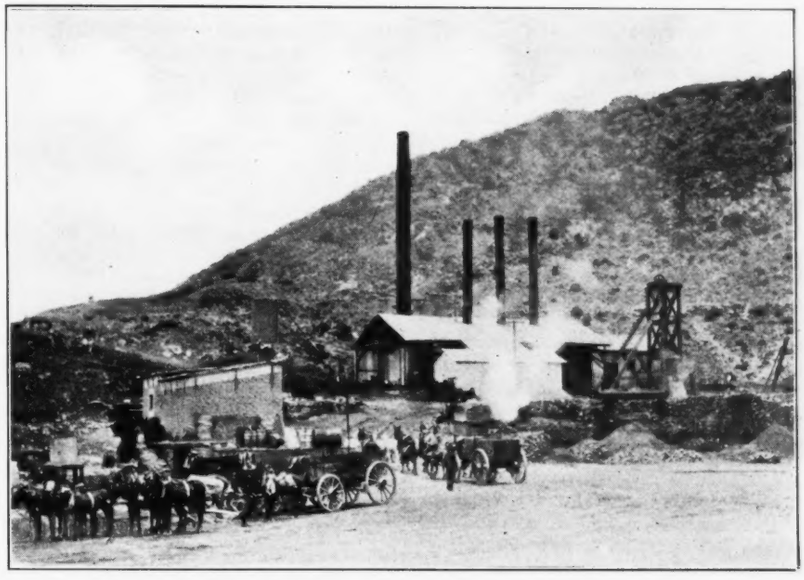
eries of large ore bodies have been found in the mines at Santa Eulalia, Chihuahua, which were recently acquired by the Cia. Minera de Peñoles from the Chihuahua Investment Co. At the present time they are shipping approximately 1,000 tons of silver-lead ore to the Chihuahua smelter. This ore assays about 17 oz. of silver and 20 per cent lead. As soon as the plant here is blown in these ores will probably be brought to Torreon for treatment.

Chihuahua

Old Adargas Properties Being Reopened and Electrically Equipped—Shipments To Start Soon

BY SANTIAGO ARTWIN

Chihuahua—The Adargas mines are situated in southern Chihuahua near Jimenez and are owned by the Cia. Minera San Pascual de las Adargas, S. A., an American corporation, with offices at El Paso, Tex. The property,



SURFACE PLANT AT ADARGAS MINES, NEAR JIMENEZ, CHIHUAHUA

MEXICO

Coahuila

Torreon Smelter's Capacity Being Overhauled by Peñoles Company

Torreon—Owing to the advance in the price of silver renewed animation is noted in this mining center and if the railroads can improve their service accordingly, a number of the mining companies and individuals will shortly resume operations.

Work is progressing rapidly on the general repairs of the Cia. Metalurgica de Torreon smelter, owned by the Cia Minera de Peñoles. The capacity is to be considerably increased by dismantling the smelter at Mapimi, owned by the same company, and the equipment added to the plant at Torreon. It is not yet known just how soon this smelter will be blown in but it is generally expected that it will be about the first of the year.

It is reported that some new discov-

which was an old Spanish mine, was rediscovered in 1890. Lead-silver-gold carbonate ore averaging about $20 per ton was shipped at low freight cost over the flat country to Dolores station, twelve miles from the mine. These operations had reached a depth of about 240 ft., when water was struck. This circumstance, together with lack of sufficient working capital and poor management, led to abandonment in the late 90's. However, work has now been actively resumed.

The Adargas properties, with the main claim of San Pascual de las Adargas, are on the southern end of the Sierra de las Adargas, the latter consisting of Cretaceous limestone. The range has been cut in several places by porphyry and andesite-porphyry dikes. One of these, running along the southern side of the main Adargas hill, has proved to be highly mineralized. This dike widens from 100 ft. to over 600 ft. within a distance of

1,000 ft. The main orebodies occur either in the limestone or along the contact and even within the dike. They are found at varying depth and distance from each other, their limit as to the depth not having been acertained. The upper carbonate ores carried 15 to 30 per cent lead, 12 to 30 oz. silver, and 0.2 to 0.5 oz. gold. The lower ores run as high as 55 per cent lead, 60 oz. and more of silver, with good values in gold. Several cross veins, extending from the main dike into the limestone of the hill, have also been worked more or less extensively, producing siliceous ores with 55 per cent lead, 170 oz. silver, 2 per cent copper, and some gold. The main shaft of the principal property has been sunk to a depth of 450 ft.

Since May, 1920, when the present company started operations, considerable work has been done. Several new headframes, a new steam power plant, an office and staff houses, a warehouse, and many other buildings have been erected. Several additional shafts have been sunk and new levels opened, with the object of improving the ventilation in the lower, wet orebodies. A 50-hp. air compressor, several Novo gas-engine hoists, and a system of underground electric lighting have been installed.

The old steam pumps have been put in condition, and the boiler capacity has been increased on account of the bad quality of feed water. No difficulty has been experienced in draining a large area of the main dike. As unwatering has progressed, the flow has decreased gradually from 600 gal. per minute at the start to only 215 gal. per minute, when the bottom of the old working was reached. This can be easily handled by a No. 11.5-in. discharge Cameron sinking pump.

Development undertaken since unwatering has proved the existence of large commercial orebodies. It has been decided, however, to continue draining the mine from the bottom of the main shaft, and to install at the surface a new electrically driven pump, having a much greater capacity than required.

The plant is to be electrified soon, the power to be furnished by the Cia. Agricola y de Fuerza Electrica del Rio Conchos, S. A., which has its power plant at La Boquilla, near Camargo. The building of the forty-five miles of transmission line from San Juan to the mines will be started as soon as the material ordered arrives. The equipment to be installed includes electrically driven pumps, a compressor plant, one double-drum and five single-drum hoists, machine shops, and a crushing and sampling plant.

In the meantime, development work is being speeded up. The main shaft is being reconstructed to a two-compartment shaft. This is to be deepened to 550 ft., after which diamond drills will be used to explore thoroughly the as yet undeveloped parts of the property.

Ore is being mined steadily, and shipments will be made to the Jiménez and Dolores stations as soon as the wagon roads are sufficiently improved to permit the steady use of several modern Buffalo steam wagons or traction engines, each having a hauling capacity of ten to thirty tons.

ARIZONA

Plaintiffs in Smoke-Damage Case Against U. V. Extension Get $1 and Costs

Phoenix—Collusion, fraud, and coercion are charged by Stephen Lucas, in a suit locally filed against the Lucky Five Mining, Milling & Reducting Co., Grace White, Ira L. Horton, and the Copper Basin Six Mines Co., in connection with a suit for $100,000 filed by Mrs. White against the Lucky Five corporation in 1918. It is alleged that the proceedings were collusive, including transfer of the property on sheriff's sale to Mrs. White's father and its later transfer to herself.

Suit has been begun in Yavapai County by R. M. Garrett for foreclosure of a mortgage for $55,477 held by him on the Bannie mining property, in the Walker district. He states he will protect legitimate investors in the company's stock.

T. N. McCauley, who is interested especially in the Central-Mascot mines near Willcox, has had prepared for exhibition in the East a 3,000-ft. film showing Arizona scenes, inclusive of the capitol building and other views around Phoenix, Willcox, and the Central mines.

Prescott — The Biles-Wells smoke-damage case against the United Verde Extension Mining Co., after a trial of six weeks, resulted in a jury verdict for the plaintiffs in the sum of $1 and costs. The costs will approximate $3,000. An attempt was made to show that the plaintiffs' crops had been diminished and their lands injured by the volume sulphuric fumes from the defendant's smelting plant at Clemenceau, in the Verde Valley, below Clarkdale. The defendant offered testimony from many expert witnesses to the effect that the alfalfa and other crops alleged to have been injured by smoke had in reality suffered from a variety of plant diseases or from growth in shallow soil, with "hard pan" present. Local witnesses told they had raised gardens near the Clemenceau smelter and had failed to observe any injurious effect from the smoke. Claims were made that the plaintiffs had refused access to their land to investigators who sought to secure data for the defendants. Similar cases near Clarkdale a number of years ago were compromised by the United Verde Copper Co., which in a number of cases bought large farm acreages said to have been injuriously affected by the furnace fumes.

Morenci—F. O. Longcor, of Newark, N. J., and associates have contracted for the erection of a cyanide mill on the Stargo silver mine, near Morenci, and for provision of funds for deeper development work. The agreement includes purchase of a large block of the Stargo company's stock, understood to give a controlling interest to Mr. Longcor's syndicate. The mill plans are being prepared by the General Engineering Co. of Salt Lake City on the basis of mill tests already made. Profitable shipments of ore from the property were made until the closing of the Douglas smelters. The company's stock has been held by George J. Stoneman, of Los Angeles; P. A. Tharaldsen, of Phoenix; W. J. Graham, of Bisbee, and M. J. Hannon, the last named having been manager.

Johnson—The Arizona-United Mining Co. is reported to have perfected plans for a concentrating plant and new working shaft, involving expenditure of a large sum. The Keystone is building a new concentrator, with a power plant including a 150-hp. Corliss engine and two 100-hp. boilers.

Benson — Reports lately spread affirming discovery of a wonderfully rich gold field near Benson are declared to be utterly without foundation, unless on the basis of a piece of rich float for which no ledge can be found. A large number of miners and prospectors made their way to Benson from many points, only to learn that the rumors were false.

Tucson — Announcement has been made by the Southern Pacific of a new ore freight rate of $10.50 a ton from Cananea and southern Arizona points to San Pedro harbor.

Jerome—On its 960 level Dundee-Arizona has crosscut into diorite, said to be full of specks of chalcocite and native copper. The work is being pushed toward a known schist dike, in which it is expected commercial ore will be found. The property was recently examined by H. V. Winchell.

Verde Central has started sinking its main shaft at least 300 ft. deeper, this preliminary to exploration at depth of the low-grade sulphide cut in drifting along the United Verde fault.

NEW MEXICO

New Discovery of Silver Reported Thirty-five Miles Northeast of Silver City

Lordsburg—A meeting of the White Syndicate that control the Last Chance mine was held Oct. 3. It was decided to sink the main shaft another 200 ft., giving a depth of 500 ft. An assay office will be built at once. Arrangements are being made to begin work on a fifty-ton flotation mill. Work has been started on the Fairly-Smith ground recently acquired.

Ore shipments from the Lordsburg district for September amounted to 1,335 tons, the approximate value being $26,700.

Silver City—A new strike of silver ore is reported to have been made by Alexander Brothers, near Dry Creek, about thirty-five miles northeast of Silver City. There is some excitement, and a number of prospectors are in the field. The ores are said to run about 30 oz. silver.

UTAH

Work Resumed at Pittsburgh Mine at American Fork—I.X.L. Property Changes Hands

Eureka—Ore shipments from the Tintic district for the week ended Sept. 30 amounted to 136 cars. Shippers were: Chief Consolidated, 38 cars; Tintic Standard, 35; Victoria, 10; Iron King, 8; Eagle & Blue Bell, 8; Swansea, 5; Sunbeam, 4; Colorado, 2; Gemini, 2; Gold Chain, 1; Yankee, 1; Eureka Hill, 1; Alaska, 1. The Chief Consolidated is preparing to market limestone from its recently acquired quarry. Grading has been started preparatory to building a railroad spur to the property. The material will be shipped to the smelters and sugar factories.

American Fork—Work is to be resumed at the Pittsburgh mine, which in the early days is said to have produced high-grade ore carrying lead, silver, and gold from a tunnel about 200 ft. long. It is proposed to build an aërial tramway and to install modern machinery. Work will be started in the No. 3 tunnel, which will give a depth of 900 to 1,000 ft. on the vein.

Park City—Shipments for the week ended Sept. 30 amounted to 1805 tons as compared with 1,436 tons the week preceding. Shippers were: Silver King Coalition, 827 tons; Judge allied companies, 58 tons, and Ontario, 410 tons.

Marysvale — The I.X.L. silver-gold property, in the Mount Baldy mining district, adjoining the Deer Trail mine, has been taken over by the American Consolidated Mines, which is said to be controlled to a large extent by owners of the Deer Trail. The mill at the latter property is treating 100 tons of ore daily and producing eight tons of concentrates according to report. The company is a close corporation.

MONTANA

Butte & Superior To Seek Its Copper Orebody on 2,600 Level

Butte—The North Butte Mining Co. has opened more than 2 ft. of high-grade ore, in which considerable glance is to be seen on the 3,600 level of the Edith May vein. This orebody presumably is the extension of the shoot opened on the 3,400 level of the same fissure.

The Butte & Superior Mining Co. drift is continuing on its showing of copper ore on the 2,200 level of the Black Rock mine, and it has been decided to drive for this vein on the 2,600 level, the deepest in the property. A distance of more than 600 ft. will have to be driven to reach a point on the lower level where the operators expect to find the copper ore.

The East Butte Mining Co. is laying a foundation of slag for new ore bins at the site where the new working shaft now being raised will hole through at the surface. The molten slag is being poured by means of traveling cranes into steel molds, a departure in the construction of ore bins in the Butte district. The East Butte has been quite successful in this style of construction in the matter of building tanks for use in its flotation concentrator. East Butte's treasury to date has $1,600,000 in cash and copper, principally copper.

Davis-Daly's crosscut on the 750 level of the Hibernia mine is expected to reach the south Hibernia vein within several weeks. Conditions at the Colorado mine are reported to remain unchanged.

The Tuolumne Copper Mining Co. in its west drift on the 1,600 level of the Spread Delight vein is showing ore of an improved grade, and it would not be surprising, according to those believed to be informed, were commercial rock to be had within a short time. The showing is regarded as the best thus far that has been opened on this level.

Elkhorn—Milling operations at the Elkhorn concentrator of the Boston & Montana Development Co. are awaiting only the completion of the building of the power line to start. Some delay has been experienced through lack of linemen to string the wires and do the necessary wiring at the mill. Plenty of help is available, but not of the skilled kind. However, the construction of the line is being pushed as rapidly as possible. The course of the east fork of the Wise River was changed recently to afford room for impounding tailings. Waste rock from development operations in the mine is being used for the building of the impounding dams.

WASHINGTON

Standard Silver-Lead Report Shows $366,275 in Cash and Security Assets

Colville—Development of the recent sensational strike of high-grade silver-lead ore on the Old Dominion mine is delayed pending installation of improved ventilation.

Spokane—The second quarterly report of the Standard Silver-Lead Mining Co., which has successfully operated a property at Silverton, B. C., for the last ten years, shows cash and security assets amounting to $366,275. The company recently disposed of its Silverton property under a bond and lease, but no substantial amount has yet been paid on this account.

Oroville—The State Supreme Court of Washington has just handed down a decision confirming title of Southern Minnesota & Washington Mining Co. to the Submarine mine, formerly known as Lone Pine property. The property is located along the international boundary and consists of twenty-one claims, upon which development has been fairly extensive. Values are silver-lead and copper, with some gold. It is believed plans for construction of a mill, which were held up pending settlement of litigation, will now be proceeded with.

NEVADA

All Available Ground Located in Argentite District—Work Resumed on Placers Near Johnnie

Winnemucca—The New Harmony Mines Co., operating four miles east of Winnemucca, has sunk the main shaft 150 ft. on the vein, and it is reported that the bottom of the shaft shows 5 ft. of $75 ore. The vein as exposed in the shaft has contained values across narrow widths directly from the surface. The shaft is to be sunk to the 300 level and the vein will then be developed by drifting.

Tonopah—It is reported that W. Hampton Williams, discoverer of the famous "Kelly" mine at Randsburg, Cal., has purchased the Eden Creek mine situated in the Kawich Range forty-five miles east of Tonopah. Small test shipments, which ran as high as $100 per ton, have been made from the property. Development is meager; a tunnel cuts the vein at a depth of 230 ft. and drifting is being done. Values are in silver and gold, with the former predominating.

Conditions and production in the Tonopah and Divide districts are normal and satisfactory. The Jim Butler and New California mines will resume ore shipments soon. No ore has been shipped from these mines since the strike and shutdown of last April. Ore shipments made by the Divide Extension during September averaged $64 per ton, and the gross value for the month is given as $48,000.

Argentite—In this district, which is twenty-four miles from Silver Peak, all available ground in the vicinity of the Sanger, or original strike, has been located. The Watterson interests, which control the Sanger property under option, are drifting both ways on the vein on the 100 level, as well as getting out a trial shipment to send to the mill at Silver Peak. A $60,000 payment is reported to be due in October and the confidence of claim owners in the district will be greatly strengthened if this payment be made. The veins in the Argentite district are strong and well defined and contain some exceedingly rich ore, but the average grade is not shipping ore. Present conditions indicate the necessity for a mill on the ground, in order to be able to realize a profit on ore in sight.

Johnnie—The weather being cooler, operations on many dry placers have been resumed. Carl James, Harry Colliers, and E. R. Mueller have obtained a lease in the Mill Canyon on the Mae claim adjoining the Eureka-Johnnie property. Jim Hogan has located several claims on the extension north and east of the Climax group. The locations were made for mining men of Oatman, Ariz. B. B. Brandt is prospecting on his group of claims southwest of the Congress mine, tracing pay gravel to the summit of a hill. A. N. Coe is working on the Evolution claim adjoining the Congress property. The values covered are reported to be very good.

MICHIGAN

The Copper Country

September Shipments of Copper Heaviest of Season—C. & H. Still Has Large Surplus

Houghton—Copper shipments out of the Lake district in September totaled 7,028,000 lb., being the heaviest made in any month of the navigation season to date, comparing with 5,176,000 lb. for August, the smallest monthly total. Shipments of copper by water to date total 30,000,000 lb. Probably 10,000,000 lb. more have gone out by rail in the five months' period. In September, Calumet & Hecla shipped by boat 2,748,000 lb., Copper Range, Mohawk, and Wolverine, 2,764,000, and Quincy, 1,516,000.

There is no immediate prospect of a reopening of the Calumet & Hecla mines. These mines still have a large metal surplus, and the properties will continue in idleness until this surplus is nearly out. All mines are being kept in good physical condition. Timbering is done when it is needed, and there have been no serious caves. All openings are being kept free of water. A small force recently was put on at Ahmeek for the purpose of doing some repair work.

The Copper Range gained a net total of fifty men in September. Several hundred men have been added to the payroll during the summer. Champion shipped 42,000 tons of "rock" to the mill in September; Baltic, 19,000, and Trimountain, 10,000. Champion ground continues rich, with no change in yield. Ground in both the Baltic and the Trimountain is running better than the average for those mines, Baltic being in particularly good ground in September. A big program of drifting is under way at Trimountain, but drifting at Champion and Baltic is still below normal. Copper Range has a comparatively small copper surplus, estimated to be not more than 5,000,000 lb.

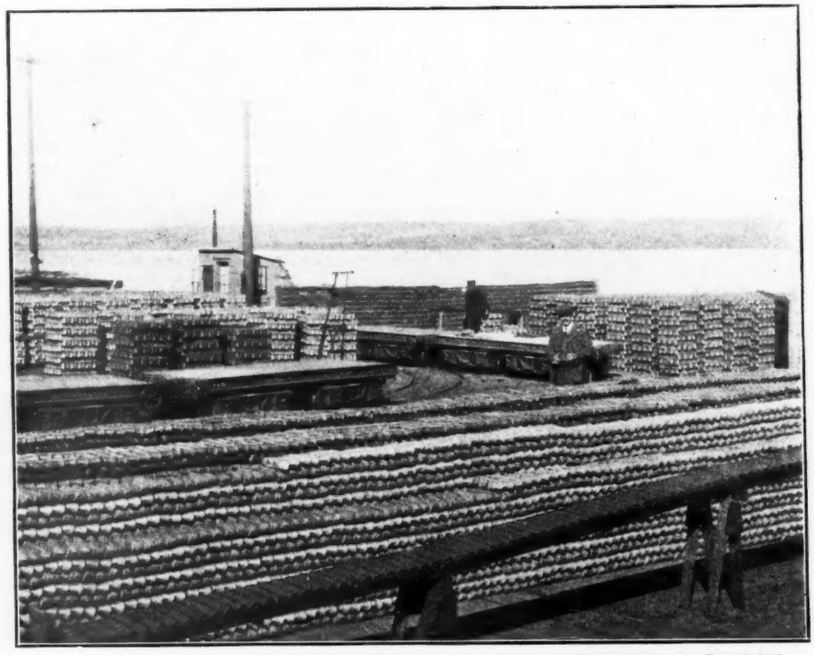
No distress is yet in evidence in the district, despite the long shutdown of the Calumet & Hecla mines. This is due to various summer activities, such as farming, road construction, and other outdoor work. It is believed organized relief will be necessary during the winter unless mining operations are resumed.

Gogebic Range

Oliver Mines Shipping at Present at Pre-War Year Rate—Contract Miners Averaging $4.06

Ironwood—Shipment of ore continues at about the same rate as for the last two months. The mines of the U. S. Steel Corporation are shipping about 78,000 tons per month, but nearly 30 per cent of this is coming from the Tilden mine, which normally furnishes less than 10 per cent of the total. If the present rate continues until the end of the season, these mines will have shipped about as much ore as in the average pre-war year, but one-third less than for the last four years. The Steel & Tube Co. of America, which last year exceeded the Steel Corporation in shipments, has this year shipped less than one-tenth as much. Of the other big producers on the range the Wakefield pit has shipped nothing, the Plymouth pit about half its usual amount, and the Ironton mine practically nothing up to the present.

The wage scale recently put in effect at the Steel Corporation's mines—and most other operators have adopted the same arrangement, gives $4.06 as the average for contract miners. All now pay contract miners a flat rate of $2.24 per shift, and then their contract price per ton or per foot of drift is supposed to bring their daily wage up to $4.06. Contract prices for stoping vary from 11c. to 30c. or more, depending on the amount of repairing, hardness of ground, and various other conditions.



COPPER AWAITING SHIPMENT, PORTAGE LAKE, NORTHERN MICHIGAN

Marquette Range

Accident Rate Much Lower in 1921 Than in 1920—Rolling Mill Pit Working

Ishpeming—The annual report of the mine inspector of Marquette County, which includes all of the operating mines on the Marquette Range, for the year which closed Sept. 30, shows that there were only four fatal accidents during the twelve months embraced by the report. This was a fatality rate of 1.09 per 1,000 men employed, as against eight accidents and a rate of 1.72 in 1920. During the year the Angeline, Lake, and American mines have been abandoned. In addition to the thirty active mines seven quarries are in operation. Most of the latter are producing crushed rock.

Negaunee—C. K. Quinn & Co. is now working its open pit at the Rolling Mill mine. All ore being taken out is shipped. More ore is now going forward from the Maas and Negaunee mines, and regular shipments are being made from the Mary Charlotte. The Richmond has suspended shipping for the season from its pit property.

Ishpeming—The Oliver Iron Mining Co. has finished shipping from its Section 16 mine for this year. Over 250,000 tons went forward, this property being the heaviest shipper on the range this season. The Oliver company has obtained permission to place two 8,000-gal. Layne-Bowler pumps in the Angeline mine, abandoned by the Cleveland-Cliffs Iron Co., to keep water from the Section 16 workings.

MINNESOTA

Mesabi Range

Stock Ore Being Shipped Before Cold Weather Sets In

Chisholm—Shipments have been resumed at the Dunwoody mine, the ore coming from stock.

The lease on the Palmer forties, which form a portion of the Hartley open pit, operated by the Oliver company, has been given up by the company.

The stockpile at the Chester mine has been shipped. The Oliver lease was surrendered several months ago.

Hibbing—The Crete Iron Mining Co., a subsidiary of Pickands, Mather & Co., is shipping 100,000 tons of ore from its stockpile at the Utica mine

THE MARKET REPORT

Daily Prices of Metals

Oct.	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
6	12.75	26 625	27 00	4.70	4.45@4.50	4.60
7	12 75	26.625	26.875	4.70	4.45@4.50	4 60
8	12.75	26.625	26 875	4.70	4.45@4.50	4.60@4.65
10	12.75	26.875	27.125	4.70	4.45@4.50	4.60@4.65
11	12.75	27.00	27.25	4 70	4.45@4.50	4.65
12	.....	.....	.....	....	.....	....

*These prices correspond to the following quotations for copper delivered: for the entire week, 13c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Oct.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
6	69	70	74	155½	157¾	23¼	23⅛	26⅝	27⅛
7	69⅜	70⅜	74½	155	157½	23⅛	22⅞	26⅝	27⅛
8	...	...	...	.....	.....	.....	.....	...	...
10	69¼	70¼	75	155¾	157¾	23⅛	22⅝	26⅝	27⅛
11	69⅜	70⅜	75½	155¾	158¼	23¼	23	26⅝	27
12	69¼	70¼	75½	155¾	158¼	23½	23¼	26⅝	27

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Oct.	Sterling Exchange "Checks"	Silver			Oct.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York, Foreign Origin	London
6	377	99¼	69⅜	41⅛	10	385	99¼	72¼	42¼
7	377¾	99¼	70⅜	41⅞	11	384	99¼	72¼	42½
8	379	99¼	71⅜	42⅜	12	....	....	....	42⅜

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon.

Metal Markets

New York, Oct. 11, 1921

Copper and zinc remain the most active metals of the week, zinc advancing slightly and copper establishing itself firmly on a 13c. level. Although the trade is gratified over the recent betterment in the metal market, it is generally felt that a further rise in prices is likely. The London market has improved concurrently with the advance in New York, the betterment being due more to the increase in sterling exchange than to the higher quotations. The holiday tomorrow necessitates closing the market report today. London quotations, however, are given for the entire week ending Oct. 12.

Copper

No copper has been reported sold during the week below 13c. delivered. The market reached this price last Thursday, and is the price at which October copper has been sold. Copper is still available at this figure, both for October and November shipment, but several producers are quoting higher prices, 13⅛c. being asked for October copper and 13¼c. for November and December. The prompt market for copper has not been as active as that for forward delivery, the largest sales of the week being copper to be shipped in November and December. Large consumers were again in the market, and were able to fill their requirements early in the week for 13c. The market is still strong, but has found a resting point at its present level. One copper manufacturer is of the opinion that the heavy purchases of the large copper consumers, which generally were forward copper, will tend to lighten the market in the next few months, as producers in the recent scramble anticipated their requirements several months ahead in order to obtain the metal at the lowest possible price. This presupposes that there will be no improvement in domestic consumption in the near future and that manufacturers will stop buying copper for future delivery, both of which assumptions are problematical.

The export business in copper has been good, with the demand distributed among various European countries, but trade with England has been lighter than usual. Recent advices from Germany report a feverish industrial activity. Export prices have risen with the advance in this market, and the metal has been sold during the week at prices ranging from 13c. to 13.25c. c.i.f. The advance in the price of London electrolytic has been the feature of the market, amounting to about 0.9c. for the week figured on a currency equivalent basis.

Lead

The American Smelting & Refining Co. continues its official contract price at 4.70c., at which level most of the New York trading has been done. The market has been more inactive than last week, and our quotations show no change. Several of the large producers report sales in fair volume. Inquiries are increasing in number. Lead is freely offered in St. Louis at 4.475c., and there is a possibility that this price can be shaded on a large order. Producers seem a little more anxious to sell their product, although the statistical position of lead continues to be good. Production is low, and stocks are not high enough to be disturbing. For future lead a premium of 5 points per month would have to be paid.

Zinc

The market has advanced slightly to 4.65c., due to support from galvanizers. The steady advance of the uast few weeks and the brisker buying have resulted in reducing the surplus stocks of zinc which have been such a depressant. Deliveries of zinc are exceeding output, and, as for the copper market, the surplus is becoming a factor of lesser importance. Forward zinc is quoted at prices 5 points higher than prompt for each month of forward delivery. High-grade zinc was sold during the week for 6c. per lb., in carload lots, with freight allowance. Although the London quotations have

held steadily, the rise in sterling has raised the currency equivalent of the American price.

Tin

The market is reported as being better, and a good business has been done. The advance in sterling exchange has increased the price here, and has made the quotation of dealers and producers vary greatly during the day. Future tin is quoted about ¼c. higher than prompt. Dealers are not inclined to quote on large orders due to the exchange difficulties and in some instances are carefully co-ordinating operations in London and New York.

Arrivals of tin in long tons: Oct. 6th, Straits, 525; 7th, Straits, 30.

Gold

Gold in London: Oct. 6th, 108s. 6d.; 7th, 108s. 8d.; 10th, 107s. 5d.; 11th, 106s. 8d.; 12th, holiday.

Foreign Exchange

The spectacular advance in sterling exchange has been the feature of the week, the total advance in seven days being about 14c. Continental rates followed sterling. The rise is ascribed as chiefly due to speculation and manipulation. On Monday, Oct. 10th, francs were 7.345c.; lire, 4.055c.; and marks, .8275c. New York funds in Montreal, 9.75 per cent premium. Sterling cables continue to be quoted ¼c. higher than the figures given on page 635.

Silver

Silver prices have advanced sharply the last week in both New York and London, New York reaching a new high for the year of 72¼c. Eastern rates have strengthened again, with China rather than India the principal buyer. This buying is apparently in anticipation of the Chinese New Year. The sudden rise in sterling exchange on the 10th was responsible for the higher New York price of silver on that date, as the London price has reacted slightly, due to small buying orders. The market closes steady, although quiet.

Mexican Dollars—Oct. 6th, 53½; 7th, 54¼; 8th, 55; 10th, 55⅝; 11th, 55⅝.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—List prices of 24.5@25c. are nominal. Outside market, 18@20c. per lb.; 18½c. for imports, duty paid.

Antimony — Chinese and Japanese brands, 5@5¼c.; market very strong. W.C.C. brand, 5¼@5⅝c. per lb. Cookson's "C" grade, spot, 9c. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 5.25c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.55 per lb.

Cadmium—Range $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt — Metal, $3@$3.25 per lb., black oxide, $2.35 per lb. in bbls.

Iridium—Nominal, $150@$170 per oz.

[1]**Molybdenum Metal** — In rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@38c. Market dead.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70 per troy oz. Nominal. $70, Los Angeles, Cal.

Palladium—Nominal, $55@$60 per oz.

Platinum—$80 per oz.

Quicksilver—$39@$41 per 75-lb flask. San Francisco wires $43.75. Dull.

[1]**Rhodium**—$150 per troy oz.

[1]**Selenium** — Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Ore analyzing 40@45 per cent Cr_2O_3, crude, $20@$25 per net ton; ground, $30; analyzing 45@50 per cent Cr_2O_3, $24@$26; ground, $28; f.o.b. Atlantic ports. Quotations are nominal.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $6.45; Mesabi bessemer, 55 per cent iron, $6.20; Old Range non-bessemer, 51½ per cent iron, $5.70; Mesabi non-bessemer, 51½ per cent iron, $5.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $4.85; old bed concentrates, 63 per cent, $5.75; Harmony, cobbed, 63 per cent, $5.75; new bed low phosphorus, 65 per cent, $8.50.

Manganese Ore—20@22c. per unit, seaport; chemical ore (MnO_2) $50@$55 per gross ton, lump; $70@$75 per net ton, powdered. Nominal.

Molybdenum Ore—85 per cent MoS_2, 50c. per lb. of contained sulphide, New York. Quotation purely nominal.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1½@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York. Nominal.

[1]Furnished by Foote Mineral Co., Philadelphia, Pa.

Zircon—Zirconium silicate, f.o.b. Pablo, Fla., 4½@ 13c. per lb., according to grade.

[1]**Zirkite**—According to conditions, $70 @$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., Oct. 8—Zinc blende, per ton high, $26.45; basis 60 per cent zinc, premium, $24; Prime Western, $23.50@$23; fines and slimes, $22@ $18; average settling price, all grades of blende, $22.12.

Lead, high, $64.40; basis 80 per cent lead, $60; average settling price, all grades of lead, $59.12 per ton.

Shipments for the week: Blende, 6,192; lead, 1,020 tons. Value, all ores the week, $197,290.

The highest authenticated blende basis price is given at $24. The purchase was 5,700 tons, a decrease of 600 tons from the previous week. Competition was particularly active on zinc ores carrying little or no lead content. Rumors of higher than $60 basis for lead ore continue in circulation week after week, with no verification.

Restarting of idle mines and mills to increase the output of lead has so far increased the output of zinc almost imperceptibly.

Platteville, Wis., Oct. 8 — Lead ore 80 per cent lead, $60 per ton. Shipments for the week: Lead ore, 122 tons. Shipments for the year: Blende, 8,461; lead ore, 1,405 tons. Shipped during week to separating plants, 440 tons blende, 50 tons sulphur ore.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $1,500@ $2,000; No. 2, $850@$1,250; spinning fibers, $350@$850; magnesia and compressed sheet fibers, $225@$350; shingle stock, $95@$150; paper stock, $55@ $70; cement stock, $16@$27.50; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada.

Barytes—Crude, 88 to 94 per cent barium sulphate, $10@$12 per net ton; ground (white) $23@$24 in bags, carload lots; (off-color) $21@$22 in bags, carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton, f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7@$10 per long ton, f.o.b. Cartersville, Ga.

Bauxite — French bauxite, $8@$10 per metric ton, c.i.f. Atlantic ports. American bauxite, crushed and dried, $8@$10 per gross ton, f.o.b. shipping points; pulverized and dried, $12@$15 per gross ton, depending upon grade; calcined so as to remove most of the combined water, $20 per gross ton, f.o.b. shipping point.

Borax—Granulated, crystals, or powdered in bags, carloads, 5½c. per lb.; in bbls. 5⅝c.

Chalk—English, extra light, 5c. Domestic light, 4½c.; heavy, 4c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $6.50@$8.50; washed, $9@$10; powdered, $12@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $13@$20, f.o.b. Virginia points. Imported lump, $12@$20, f.o.b. American ports; powdered, $25@$40, f.o.b., quoted at New York.

Emery—Turkish emery, 6c. per lb., depending upon fineness. Inferior grades, 3½c., f.o.b., from New England points.

Feldspar—No. 1 soap grade, $7@$7.50 per ton, f.o.b. North Carolina points; No. 1 pottery, $6@$6.50; No. 2, $5@$5.50. Market dull. For No. 1, Canadian, ground, $23, f.o.b. Ohio points.

Transactions are reported on a $5 basis for crude No. 1; prices are still nominal.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20@$22.50 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; gravel, $15; lump, $12.50, f.o.b. Lordsburg, N. M. Ground, acid grade, 97 per cent CaF_2, $30, New Mexico.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 6@7c. per lb.; chip, 4½@5c.; dust, 3@4c. No. 1 flake, 5@6c.; amorphous crude, ¾@2½c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$1.75 per net ton; 1½ in., $1.35@$1.70. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined — Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $45@$50 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead-Burned — $33 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $53.80 per ton, f.o.b., Chester, Pa. (Magnesite brick—See Refractories.)

Mica — India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); ground roofing mica, $25@$70, all f.o.b. New York.

[1]**Monazite** — Minimum of 6 per cent thorium oxide, $30 per unit, duty paid.

[1]Foote Mineral Co., Philadelphia, Pa.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $11.65; 75 per cent, $10.65; 75@74 per cent, $10.15; 70 per cent, $6.25; 68 per cent, $5.75; 68@66 per cent, $5.50.

Pumice Stone — Imported, lump, 3@40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 13c.; Spanish lump, 13@14c.; domestic fines, f.o.b. mines, Georgia, 11@12c.

Silica — Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported dull.

Sulphur—$16@$18 per ton for domestic, f.o.b. Texas and Louisiana mines; $18@$20 for export, f.a.s. New York.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $16@$35, talcum powder grade. Southern talc, powdered, carload lots, $7.50@$11 per ton; less than carload, $25, f.o.b. cars. Imported, $30@$40; Canadian, $18@$40 per ton.

Mineral Products

Arsenic—5¾@6. per lb.

Sodium Nitrate—$2.25@$2.30 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $12.50 per ton, f.o.b. in bulk, Western mines, spot and six months' contract; $20@$22 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.20 per unit, basis 90 per cent, f.o.b. New York.

Ferro-Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 11c. per lb. of chromium contained; 4 to 6 per cent carbon, 11@12c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $60@$63, f.o.b. furnace; resale, $90, delivered; English and German, $60@$63, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $25@$27 per gross ton, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.25 per lb. of contained metal, f.o.b. works. Imported material, $1.70@$2.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $38@$40; 50 per cent, $60@$65; 75 per cent, $130@$135.

Ferrotungsten—Domestic, 70 to 80 per cent W, 40@45c. per lb. of contained tungsten, f.o.b. works. Foreign, 50c., duty paid, f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$4.25@$4.50 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 20.50c. per lb.; wire 14.50c.

Lead Sheets—Full lead sheets, 7¾c.; cut lead sheets, 8c. in quantity, mill lots.

Nickel Silver—29.50c. per lb. for 18 per cent nickel. Grade "A" sheets.

Yellow Metal — Dimension sheets, 16.25c.; sheathing, 15.25c.; rods, ½ to 3 in., 13.25c.

Zinc Sheets—$10 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter.

Refractories

Bauxite Brick—56 per cent alumina, $50 per ton; 76 per cent, $90@$95 f.o.b. works.

Chrome Cement — 40@45 per cent Cr_2O_3, $30@$32 per net ton, and $31 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—$52@$55 per net ton.

Fire Brick—First quality, 9-in. shapes, $35@$40 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $30@$35.

Magnesite Brick—9-in. straights, $65@$70 per net ton; 9-in. arches, wedges and keys, $77; soaps and splits, $98, f.o.b. works.

Silica Brick—9-in., per 1,000; $35@$45 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, Oct. 11, 1921

Production of steel ingots in September was at the rate of 32 per cent of capacity, against a 30 per cent rate in August.

The Steel Corporation's unfilled obligations increased by 28,744 tons during September.

Independent sheet mills have started advancing prices again, to a basis of 3.25c. for black sheets. Mills continue to try to accumulate enough bar, shape, and plate tonnage to enable them to advance prices, the objective being 1.65c. for bars and 1.75c. for shapes and plates.

Pig Iron—Railroads are reducing iron-ore freights 28 per cent, to put them back to the level obtaining prior to the 40 per cent advance of Aug. 26, 1920. As the furnaces have large piles of iron ore, the reduction is of little immediate benefit, and reductions in coke and limestone, which are being shipped every day, would be much more welcome. The market is quiet at former prices: Bessemer, $20; basic, $19.25 to $20; foundry, $21, f.o.b. Valley furnace, freight to Pittsburgh being $1.96.

Coke

Connellsville—Furnace, $3.25@$3.50; foundry, $4.25@$4.50.

The Copper Market Improves

Metal in Better Position Than for Many Months—Domestic Trade Lending Greater Support to the Market—1921 Production Will Be Lowest in Twenty-Four Years

EDITORIAL MARKET STUDY

WERE THE RECOVERY in the copper market the sole evidence of any fundamental change in business conditions, the improvement might be heralded as transitory, and as due chiefly to manipulation, and incapable of being sustained. However, copper is only one of the metals that has increased in price lately; zinc, lead, and silver have taken a prominent part in the upturn. This rise seems to be but one factor in the sentiment gaining headway in the country that business conditions have become better and that trade recovery is at hand.

As raw materials have long been abnormally depressed, they are ungrudgingly granted the advance in price. Copper has for months been below the cost of production and below the pre-war normal average price. The recent advance which carried it from a low of 11.625c. to present prices of 13c. indicates a partial return to a rational price level. The recovery is in large part due to the measures adopted by copper producers early this year after they had realized the seriousness of the situation, the huge excess copper stocks in the country, and the comparatively inactive state of the foreign and domestic market. The plans which were then executed, curtailing production, financing a goodly part of the copper surplus, and stimulating consumption, have produced results that could not help being beneficial. Domestic copper consumers are again buying in fair volume, and the large amounts of scrap copper which have been a depressant to the use of newly mined metal are becoming diminished. The recent scarcity of casting copper, which is manufactured from scrap, is a good indication that supplies of old metal are no longer over-plentiful.

Whether the advance in copper prices is merely affording the producers a breathing spell or is the beginning of a convalescent period is a subject upon which opinion is divided. Substantial betterment in the situation depends greatly on export trade in copper. Any foreign or domestic developments which tend to influence European buying will be of much concern to the American copper miner. The steady depreciation of the German mark and the general instability of foreign exchange have always profoundly affected export business. The accompanying uncertainty about Germany's financial affairs and ability to meet reparations is an element of first importance to the market.

The dependence of the American copper-mining industry upon German imports of copper is well known. The figures of monthly copper movements since the beginning of 1921 show that Germany has been the greatest foreign purchaser of American copper. Especially has this been true in the last few months. In June, July, and August the amount of copper consumed by Germany was over 43 per cent of the total amount exported from the United States, which approaches the pre-war rate of consumption. Figures of copper exported from the United States do not show whether the metal is intended for storage purposes in the warehouses of the Copper Export Association, or will be consumed immediately. The warehouses at such ports as Bremen, Hamburg, Liverpool, Havre, and other European cities are used to facilitate the quick and convenient shipment of American copper to interior European points.

The U. S. Geological Survey has announced that the surplus stocks of copper in the United States on Sept. 1 amounted to 405,051 tons of pig copper at smelters and refined metal ready for the market, a figure that does not include copper in transit and in process of refining. Although of large magnitude, this estimate was made for a date previous to which trading had been exceptionally quiet. During September, however, sales were heavy enough to make a deep dent in surplus stocks; brass, wire, power, and telegraph companies and electrical manufacturers all were in the market for larger amounts of metal than they had purchased earlier this year. Stocks in consumers hands are believed to be low, and this, with the desire of getting in at the bottom of the market, has likely been an impelling motive in the recent buying. Consumers have been anxious to cover future requirements, but have not met with great success from the producers, who are just as anxious to avoid making future sales. The bugbear of surplus stocks has caused many consumers, foreign and domestic, to believe that the copper market's future was virtually in their hands, and that a sustained rise was out of the question under present circumstances. This reasoning exaggerates the importance of surplus stocks and loses its force when the financial arrangements made to carry them are considered. The agreement between the bankers and the producers has proved highly satisfactory in operation, despite some foreign comments to the contrary, and has greatly eased the pressure which would have been exerted by individually held accumulations. Merchants who have worked through similar periods of excess stocks of raw materials, agriculture and mineral, have often affirmed that when once on the decline, such stocks have disappeared with surprising rapidity, and it would not be unusual if this experience were duplicated in copper.

The world is not suffering from over-production but from under-consumption. A great market exists for copper, whether new uses are discovered for it or not—a market that should be sufficiently broad to absorb the surplus more speedily than has been considered possible.

Production of copper in the United States for 1921 is estimated at 502,000,000 lb., assuming that production will continue for the remainder of the year at its curtailed rate. This production will be the lowest since 1897, before the days of the large porphyries, when domestic production amounted to 494,100,000 lb. From 1909 to 1913, a normal period of slight growth in the industry, copper production averaged 1,434,500,000 lb. The record for 1921 will thus leave a big hole in the statistical table of production.

Concurrently with the improvement in the market, the impression may grow that it is an opportune time for the mines to start operating again. The heavy expense to which most copper companies are put in keeping their properties idle will add weight to the argument. From the producers' standpoint it is undoubtedly preferable to take a small operating loss, with a possible chance of breaking even, rather than a heavy one from an unproductive plant. There is also the possibility that some companies will be over-eager to join the mines that have not stopped production, mines that will naturally be the first to feel the improved market. A premature resumption of operation would be unfortunate. Although the day seems much closer at hand to start the wheels of the industry turning again, the wisest policy is a continuation of the sacrifice the industry is making until there is no doubt that the statistical position of copper has improved and that the menace of surplus copper stocks and secondary metals is eliminated.

COPPER MOVEMENTS TO AND FROM THE UNITED STATES

In Pounds

	Average Monthly Pre-war	Average Monthly 1920	Jan., 1921	Feb., 1921	March, 1921	April, 1921	May, 1921	June, 1921	July, 1921	August, 1921
EXPORTS										
United Kingdom	5,583,000	8,290,000	8,668,000	18,970,100	7,407,000	7,976,600	6,765,000	2,826,300	1,597,100	1,234,400
France	11,530,000	9,874,000	15,012,000	10,243,000	2,926,000	10,800,000	4,455,000	7,310,600	4,710,400	6,091,400
Germany	18,366,000	7,432,000	18,802,000	20,725,000	19,021,000	15,838,000	7,074,000	22,485,400	23,687,800	16,428,100
Total (all countries)	67,266,000	51,968,000	54,855,399	62,480,000	38,720,000	41,495,000	35,378,000	50,169,400	51,771,800	42,891,000
IMPORTS										
Total (all countries)	28,350,000	30,770,000	31,136,000	30,056,000	12,808,000	29,569,000	12,689,000	20,967,100	32,095,800	23,126,000

COMPANY REPORTS

Chief Consolidated Mining Co.

Silver, Lead; Utah

The operations of the Chief Consolidated Mining Co. during the quarter ended June 30, 1921, showed a net profit of $45,239.07, a slight increase over the preceding quarter. The development footage and tonnage of ore shipped was greater also. The lower silver content of the ore (33.917 oz. per ton for the silver-lead ore, compared with 35.678 oz. in the first quarter) was balanced by an increase of lead (21.28 per cent instead of 17.24), and thus the average gross value of the ore remained about the same. Ore was produced from all the ore channels and all levels. Development progressed on the basis of about six miles per year. Work was begun in sinking the Water Lily shaft for the purpose of further developing the eastern portion of the property, which is considered promising. The speed made in this undertaking has recently been reported in the pages of the *Engineering and Mining Journal.*

The average gross value of all ores was, per ton, $40.02; smelting, freight and sampling was 60c. higher than for the first quarter, at $18.46, leaving a net value of $21.56 per ton.

Two Arizona Copper Co. Reports Show Losses in 1920 and 1921

The Arizona Copper Co. has issued two reports, one for the fiscal year ending Sept. 30, 1920, and another covering the period from Oct. 1, 1920, to May 31, 1921. The report of operations of the Arizona Copper Co. for the year ending Sept. 30, 1920, states that 17,486 tons of Bessemer copper was produced. Revenue statement follows:

	£	s.	d.	£	s.	d.
Copper company's operations						
Loss on copper, less profit on stores and rents received				39,086	13	11
Add						
Expenses of administration at Clifton	25,327	6	11			
Interest paid in the United States, less received	27,090	11	3			
Taxes in the United States paid and accrued	107,597	1	9			
	£160,014	19	11			
Public subscriptions in Arizona	2,413	8	1			
	£162,428	8	0			
Charges and expenses in Edinburgh (less received for transfer fees, £663, 17s. 6d.)	10,333	0	7	172,761	8	7
				£211,848	2	6
Deduct						
Sums received in respect of holdings in other companies: Interest and dividends for the year				£28,288	15	4
				£183,559	7	2
Interest received, less paid				4,812	13	3
				£178,746	13	11
Add						
Amount carried to reserve for contingent liabilities				120,925	19	1
Amount carried to reserve account for capital outlay				20,000	0	0
Deficiency				£319,672	13	0
Against which there fall to be placed						
Claim for repayment of excess profits duty	£292,373	0	0			
Provision for Federal taxes in previous years of amounts paid, not now required	96,575	6	10			
				388,948	6	10
Surplus				£69,275	13	10
Out of which are payable						
1. Dividend on "A" preference shares of year to Sept. 30, 1920	£2,374	0	0			
2. Dividend on preference stock for year to Sept. 30, 1920	22,157	2	0			
				24,531	2	0
Surplus, after paying preferential dividends				£44,744	11	10
Add						
Balance at the credit of the profit and loss account at Sept. 30, 1919				20,365	14	0
Balance at the credit of profit and loss at Sept. 30, 1920				£65,110	5	10

A report of operations of the Arizona Copper Co. for the period beginning Oct. 1, 1920, and ending May 31, 1921, states that 18,500,000 lb. of copper was produced in the interval. Profit and loss account follows:

	£	s.	d.	£	s.	d.
I. Six months to March 31, 1921						
Copper production, bessemer and electrolytic copper				£378,973	3	11
Working expenses of mines, concentrating, smelting, bessemerizing, refining, and disposing of copper, and loss on stores, less rents received				543,320	15	0
Loss on copper and stores, less rents received				£164,347	11	1
Add						
Expenses of administration at Clifton	11,458	17	8			
Interest paid in the United States less received	26,098	5	2			
Taxes in the United States paid and accrued	52,200	19	3			
	£89,758	2	1			
Public subscriptions in Arizona	1,248	2	1			
Charges and expenses in Edinburgh (less received for transfer fees, £177, 12s, 6d.)	£91,006	4	2			
	5,504	12	9	96,510	16	11
				£260,858	8	0
Deduct						
Sums received in respect of holdings in other companies Interest and dividends for the six months				12,089	11	9
				£248,768	16	3
Interest received, less paid				2,429	4	1
				£246,339	12	2
Add						
Amount carried to reserve for contingent liabilities				7,938	1	1
Deficiency				£254,277	13	3
Dividend on "A" preference shares for six months to March 31, 1921	£1,187	0	0			
Dividend on preference stock for six months to March 31, 1921	11,078	11	0			
				12,265	11	0
Deficiency for six months to March 31, 1921, after paying preferential dividends				£266,543	4	3
II. Two months to May 31, 1921						
The deficiency for the two months to May 31, 1921, after paying preferential dividends, is estimated to amount to				42,690	18	9
Deficiency for eight months to May 31, 1921, after paying preferential dividends				£309,234	3	0
Deduct balance at credit of profit-and-loss account at Sept. 30, 1920				65,110	5	10
Net deficiency at May 31, 1921				£244,123	17	2

The Arizona Copper Co. has now been taken over by the Phelps Dodge Corporation. Details of the purchase and agreements made were published in the issue of *Engineering and Mining Journal* of Oct. 8.

Capitalization: "A" preference shares, £7,480 10s., in shares of 5s. each; £316,530 in shares of preference stock; £379,974 in ordinary shares of 5s. each.

Mining Dividends for September, 1921

The following dividends were paid by mining and metallurgical companies during September, 1921:

Companies in the United States	Situation	Per Share	Total
American Smelting & Ref. pfd	U. S.	$1.75 Q	$875,000
Calumet & Arizona, c	Ariz.	.50 Q	321,260
Federal Mining & Smelting pfd., s.l	Idaho	1.00 Q	120,000
Hecla Mining, s.l	Idaho	.10 Q	100,000
Homestake Mining, g	S. D.	.25 M	62,790
National Lead com	U. S.	1.50 Q	309,831
National Lead pfd	U. S.	1.75 Q	426,433
Rochester Silver Corporation, s.g	Nev.	.025 Q	44,268
St. Joseph Lead	Mo.	.25 Q	352,367
United Verde Copper	Ariz.	1.50 Q	450,000
Utah Copper	Utah	.50 Q	812,245
Companies in Canada			
Hollinger Consolidated Gold	Ont.	.05 4 wk.	246,000
McIntyre Porcupine, g	Ont.	.05 I	182,014

Q, quarterly; M, monthly; I, irregular; c, copper; l, lead; s, silver; g, gold.

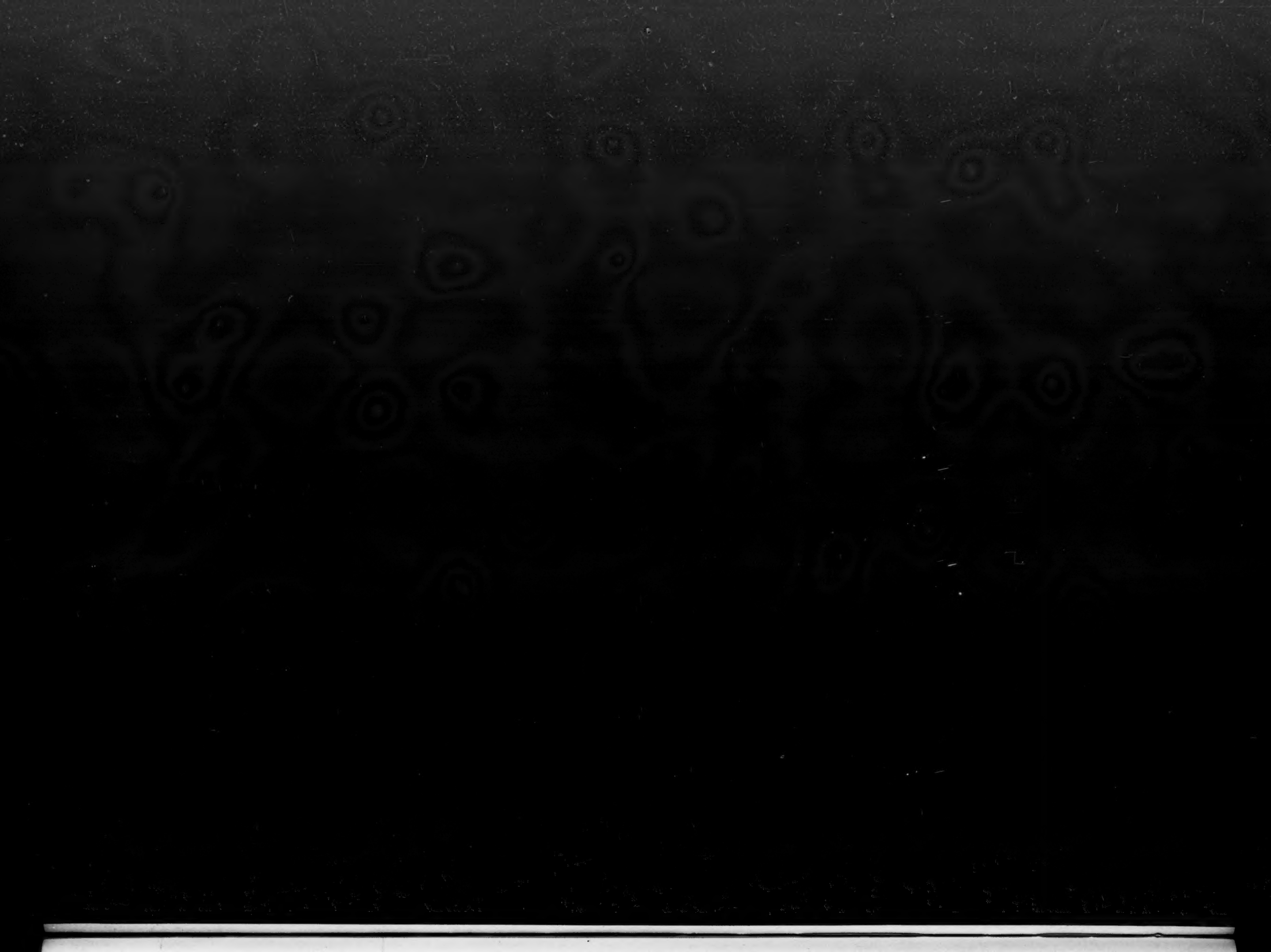
The disbursements made exhibit little change from those previously made by these companies.

MINING STOCKS

Week Ended October 8, 1921

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Ahmeek	Boston	57	54½	55½	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	*44	*38	*39		
Allouez	Boston	21	21	21	Mar. '19	1.00
Anaconda	New York	41½	40½	40½	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2	1½	2		
Ariz. Com'l	Boston	9¾	8½	9¼	Oct. '18, Q	.50
Big Ledge	N. Y. Curb	*40	*28	*30		
Bingham Mines	Boston	14	13	13½	Sept. '19, Q	.25
Calumet & Arizona	Boston			45½	Sept. '21 Q	.50
Calumet & Hecla	Boston	245	238	240	June '20, Q	5.00
Canada Copper	N. Y. Curb	*39	*30	*30		
Centennial	Boston	9¼	8¾	8¾	Dec. '18, SA	1.00
Cerro de Pasco	New York	30⅜	28½	30½	Mar. '21, Q	.50
Chile Copper	New York	12⅝	11½	11⅝		
Chino	New York	26½	25⅝	25⅞	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*18	*17½	*17½		
Con. Arizona	N. Y. Curb			*1	Dec. '18, Q	.05
Con. Copper Mines	N. Y. Curb	1¼	1¼	1¼		
Copper Range	Boston	36½	36	36½	Sept. '20, Q	.50
Crystal Copper	Boston Curb	*27	*20	*22		
Davis-Daly	Boston	7⅜	6⅞	7⅛	Mar. '20, Q	.25
East Butte	Boston	10	9½	9⅝	Dec. '19, A	.50
First National	Boston Curb	*95	*80	*90	Feb. '19, SA	.15
Franklin	Boston	3	2½	2½		
Gadsden Copper	Boston Curb			*45		
Granby Consol	New York	21⅜	20	21	May '19, Q	1.25
Greene-Cananea	New York	24⅞	22¼	22¼	Nov. '20, Q	.50
Hancock	Boston	2½	2½	2½		
Howe Sound	N. Y. Curb	2⅝	2¼	2⅜	Jan. '21, Q	.05
Inspiration Consol.	New York	36⅛	35⅜	35½	Oct. '20, Q	1.00
Iron Cap	Boston Curb	6⅛	6	6½	Sept. '20, K	.25
Isle Royale	Boston	21	20	21	Sept. '19, SA	.50
Kennecott	New York	22½	20⅞	21⅜	Dec. '20, Q	.50
Keweenaw	Boston	1½	*99	*99		
Lake Copper	Boston	2⅞	2⅞	2½		
La Salle	Boston	2	1½	1½		
Magma Chief	N. Y. Curb	*8	*8	*8		
Magma Copper	N. Y. Curb	*22½	*21½	*22½	Jan. '19, Q	.50
Majestic	Boston Curb	*6	*6	*6		
Mason Valley	Boston	1⅜	1⅜	1⅜		
Mass Consolidated	Boston	2⅜	2¼	2¼	Nov. '17, Q	1.00
Miami Copper	New York	22⅝	21½	22⅜	Aug. '21, Q	.50
Michigan	Boston	2½	2¼	2½		
Mohawk	Boston	54	53	53½	Nov. '20, Q	1.00
Mother Lode Coa.	N. Y. Curb	4½	3¾	4¼		
Nevada Consol.	New York	12½	11½	11⅝	Sept. '20, Q	.25
New Baltic	Boston Curb			3		
New Cornelia	Boston	15	14½	14¾	Aug. '20, K	.25
North Butte	Boston	11⅜	10⅜	11¼	Oct. '18, Q	.25
North Lake	Boston	*30	*30	*30		
Ohio Copper	N. Y. Curb			*6		
Old Dominion	Boston	25	24	24	Dec. '18, Q	1.00
Osceola	Boston	30	28	28½	June '20, Q	.50
Phelps Dodge	Open Mar.	†165	†155		Oct. '21, Q	1.00
Quincy	Boston	41	38	40	Mar. '20, Q	1.00
Ray Consolidated	New York	14½	13⅜	13⅞	Dec. '20, Q	.25
Ray Hercules	N. Y. Curb	*25	*19	*22		
St. Mary's Min. Ld.	Boston	40	38	38	June '20, K	2.00
Seneca Copper	Boston			13½		
Shannon	Boston	1⅜	1⅛	1⅛	Nov. '17, Q	.25
Shattuck Arizona	New York			7⅛	Jan. '20, Q	.25
South Lake	Boston	†1½	†*50	1		
Superior & Boston	Boston	2	1⅜	2		
Tenn. C. & C. cfs.	New York	8	7⅛	7	May '18, I	1.00
Tuolumne	Boston	*50	*44	*44	May '13	.10
United Verde Ex.	Boston Curb	28	26	27	May '21, Q	.25
Utah Consol	Boston	4	3	3	Sept. '18,	.25
Utah Copper	New York	53½	51⅛	52⅛	June '21 Q	.50
Utah Metal & T.	Boston	1⅜	1⅜	1⅜	Dec. '17,	.30
Victoria	Boston	1½	1½	1½		
Winona	Boston	*60	*45	*55		
Wolverine	Boston	12	11	11		
NICKEL-COPPER						
Internat. Nickel	New York	14⅜	13⅞	14¼	Mar. '19,	.50
Internat. Nickel, pf.	New York	76	75	75	Aug. '21, Q	1.50
LEAD						
National Lead	New York	76	74¼	74⅞	Sept. '21, Q	1.50
National Lead, pfd.	New York			102	Sept. '21, Q	1.75
St. Joseph Lead	New York	12¼	11⅛	11	Sept. '21, Q	.25
QUICKSILVER						
New Idria	Boston	†*50		*50		
ZINC						
Am. Z. L. & S.	New York	10¼	9¼	9¼	May '20,	1.00
Am. Z. L. & S. pfd.	New York	30	30	30	Nov. '20, Q	1.50
Butte C. & Z.	New York	4¼	4¼	4¼	June '18,	.50
Butte & Superior	New York	14¼	13⅞	14	Sept. '20,	1.25
Callahan Zn-Ld.	New York	4¼	4¼	4¼	Dec. '20, Q	.50
New Jersey Zn.	N. Y. Curb	122¾	119	121	Aug. '21, Q	2.00
Success	N. Y. Curb			2	July '16	.03
Yellow Pine	Los Angeles	*45	*20	*55	Sept. '20, Q	.03

Stock	Exch.	High	Low	Last		Last Div.
GOLD						
Alaska Gold	New York	1/32	1/32	1/32		
Alaska Juneau	New York	1/32	1/32	1/32		
Carson Hill	Boston	15/16	14	14		
Cresson Consol. G.	N. Y. Curb	1 11/16	1⅛	1 1/16	June '20, Q	$0.10
Dome Extension	Toronto	*70				
Dome Mines	New York	19	18⅜	18½	July '21, Q	.25
Florence Goldfield	N.Y. Curb	*48	*44	*45		
Golden Cycle	Colo. Springs	*67	*67	*67	June '21, Q	.02
Goldfield Consol.	N. Y. Curb	*7	*3	*3	Dec. '19,	.05
Hollinger Consol.	Toronto	7.50	7.35	7.45	Oct., '21, 4 wks.	.05
Homestake Mining	New York	57	56	56	Sept. '21, M	.25
Kirkland Lake	Toronto	*37	*30	*37		
Lake Shore	Toronto	1.36	1.25	1.28	Aug. '21, K	.02
McIntyre-Porcupine	Toronto	1.97	1.93	1.95	Sept. '21, K	.05
Porcupine Crown	Toronto	*17	*14½	*16½	July '17,	.03
Porcupine V. N. T.	Toronto	*19½	*18	*19½		
Portland	Colo. Springs	†*42	*35	*36½	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb			*4	May '19,	.05
Schumacher	Toronto	*26	*24	*25		
Silver Pick	N. Y. Curb	*9	*9	*9		
Teck Hughes	Toronto	*17½	*15	*16		
Tom Reed	Los Angeles	*70	*62½	*63	Dec. '19,	.02
United Eastern	N. Y. Curb	2½	2¼	2¼	July '21, Q	.15
Vindicator Consol.	Colo. Springs	*22	*22	*22	Jan. '20, Q	.01
White Caps Mining	N. Y. Curb	*3	*2	*2		
Yukon Gold	N. Y. Curb	1⅜	1¼	1⅜	June '18,	.02½
SILVER						
Arizona Silver	Boston Curb	*20	*17	*20	Apr. '20, M	.03
Batopilas Mining	New York	3/32	1/32	3/32	Dec. '07, I	.12½
Beaver Consol	Toronto	*26	*24	*25	May '20, K	.03
Coniagas	Toronto	1.65	1.55	1.65	May '21, Q	.12½
Crown Reserve	Toronto	*15	*11½	*13½	Jan. '17,	.05
Kerr Lake	N. Y. Curb	3½	3⅛	3½	July '21, Q	.12½
La Rose	Toronto	*34	*31½	*34	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*26½	*22	*24	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.18	1.10	1.18	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	5⅛	5	5⅛	July '21, Q	.15
Ontario Silver	New York	4¼	4⅛	4¼	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb			*11	Jan. '12,	.10
Temiskaming	Toronto	*27	*21	*21	Jan. '20, K	.04
Trethewey	Toronto	*14	*12½	*12½	Jan. '19,	.05
GOLD AND SILVER						
Barnes-King	Butte			*60	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	1⅛	1	1⅛		
Cash Boy	N. Y. Curb	*5	*5	*5		
Consol. Virginia	San Francisco	*36	*31	*36		
Dolores Esperanza	N. Y. Curb	1⅜	1⅛	1⅜		
El Salvador	N. Y. Curb	*21	*16	*18		
Jim Butler	N. Y. Curb			*7	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*4	*3	*3	June '16,	.05
Louisiana Con	N. Y. Curb			½		
MacNamara M.& M.	N. Y. Curb	*15	*14	*15	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.			4	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1 1/16	1⅛	1 1/16	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	*81	*68	*75		
Tonopah-Extension	N. Y. Curb	1⅛	1⅛	1⅛	Oct. '21, Q	.05
Tonopah Mining	N. Y. Curb	1 1/16	1⅛	1⅛	Apr. '21, SA	.05
West End Consol.	N. Y. Curb	1	*87	1	Dec. '19, SA	.05
SILVER-LEAD						
Caledonia	N. Y. Curb	*6	*6	*6	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	†1.15	†1.00	1.07½	Dec. '20,	.15
Chief Consol.	Boston Curb	†2½	†2⅜	2⅜	Aug. '21, Q	.05
Consol. M. & S.	Montreal	16	16	16	Oct. '20, Q	.62½
Daly Mining	Salt Lake	†3.00	†1.00		July '20, Q	.10
Daly-West	Boston	2¼	2⅛	2⅛	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	†2½	†2	2	Apr. '21, K	.05
Electric Point	Spokane	*6½	*6	*6½	May '20, SA	.03
Eureka-Croesus	N. Y. Curb	*49	*39	*40		
Federal M. & S.	New York	7½	7⅛	7⅛	Jan. '09,	1.50
Federal M. & S., pfd	New York	24½	23	24½	Sept. '21, Q	1.00
Florence Silver	Spokane			*10	Apr. '19,	.01½
Grand Central	Salt Lake		†*15		June '20, K	.03
Hecla Mining	N. Y. Curb	4½	4 1/16	4½	Sept. '21, Q	.10
Iron Blossom Con.	N. Y. Curb	*18	*18	*18	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	†3.50	†1.50		Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*4	*4	*4	June '21, I	.02
Prince Consol.	Salt Lake	*8½	*6½	*8½	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*2	*1	1½	Feb. '19,	.01
Rex Consol	N. Y. Curb	*11	*9	*10		
South Hecla	Salt Lake	†*30			Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	*12	*10	*12	Oct. '17,	.05
Stewart Mining	N. Y. Curb	*4	*4	*4	Dec. '15	.05
Tamarack-Custer	Spokane	1.75	1.65	1.75	Jan. '21 K	.04
Tintic Standard	Salt Lake	2.05	1.82½	2.02½	July '21, Q	.05
Utah Apex	Boston	3⅛	2 1/16	3	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb			*2	Nov. '17,	.01
VANADIUM						
Vanadium Corp.	New York	32½	30½	31½	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	48	47	47	July '21, Q	1.50
Asbestos Corp., pfd.	Montreal	70½	69½	70½	July '21, Q	1.75
MINING, SMELTING AND REFINING						
Amer. Sm. & Ref.	New York	39⅛	37⅛	38	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf	New York	78¼	75⅛	75½	Sept '21, Q	1.75
Am. Sm. pf. A	New York	72½	70	72½	Oct. '21, Q	1.50
U. S. Sm. R. & M.	New York	34½	34	34	Jan. '21, Q	.50
U.S.Sm.R.& M. pf.	New York	40½	39	39	July. '21, Q	.87

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Oil; Colorado Springs, The Financial Press, N. Y.